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NEWTON AND NEWTONIANISM

New Studies

edited by

J.E. FORCE AND S. HUTTON

KLUWER ACADEMIC PUBLISHERS

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PREFACE

Sir Isaac Newton's pre-eminence in the history of science remains fixed, yet the picture which we have of the whole man, and of the influence of his wide-ranging intellect, has been changing rapidly as scholars have increasingly taken cognizance of those aspects of Newton's thought hitherto hidden in his unpublished manuscripts. At the start of the third millennium, we find ourselves poised to launch the greatest revolution yet in Newton studies as an international team of scholars has been assembled to publish all of Newton's widely scattered unpublished papers. The William Andrews Clark Memorial Library has been associated with the world of Newtonian scholarship for some years through its purchase, in 1961, of an important manuscript ("Paradoxical Questions concerning ye morals & Actions of Athanasius & his followers") and through its long association with Professor Richard H. Popkin (U.C.L.A.) and Professor James E. Force (University of Kentucky). Through the generous sponsorship of both the U.C.L.A. Center for 17th- and 18th-Century Studies and the U.C.L.A. William Andrews Clark Memorial Library—which are under the direction of Professor Peter H. Reill—Professors Force and Popkin were able to stage a series of Clark Library conferences devoted to Newton throughout the 1990s. The papers delivered at these conferences evolved into a series of important edited volumes whose general theme was the centrality of theological and religious ideas to Newton's intellectual formation. In the present volume, this longstanding project continues. Once again thanks to the generosity of Professor Reill and the resources of the U.C.L.A. Center for 17th- and 18th-Century Studies and the Clark Library, in November, 2000, Professor Force and Dr Sarah Hutton (Middlesex University) organized a conference at the Clark Library which aimed to review the current state of Newtonian scholarship and to describe the revolution that the publication of Newton's manuscripts was bringing about in Newton studies. Several of the speakers, whose papers are included in this volume, are eminent scholars connected with the Newton Project, based in London and Cambridge, which aims to publish all Newton's unpublished writings. All of the essays included in this collection elucidate either the current state of Newtonian studies or the seminal figure of Sir Isaac Newton himself who embodies so many of the complex and seemingly paradoxical patterns of the Enlightenment.

James E. Force
Sarah Hutton

INTRODUCTION

MARGARET C. JACOB
University of California, Los Angeles

They have now all passed away. The greats of the previous era of Newton scholarship—I. B. Cohen, B. J. T. Dobbs, Henry Guerlac, Frank Manuel, Richard Westfall, Derek (Tom) Whiteside—will never again contribute to Newtonian scholarship. Their achievements were massively impressive, even if considered solely on the level of transcription and editing. Before the 1960s we had no definitive published correspondence, no background mathematical papers, none of the critically important manuscript material in print, and we possessed a rationalist definition of science that was alien to what Newton was trying to do. That group of scholars rescued Newton from the positivist oblivion to which he had been consigned. The opening essay in this collection by Margaret Osler does a fine job at describing their major achievements in far greater detail than I can offer here.

Yet even after their labors, one area remained relatively untouched, Newton's voluminous theological writings. By the 1980s, everyone who studied Newton and Newtonianism had come somewhat belatedly to recognize the importance of his theology. As the essays by Richard Popkin and Rob Iliffe presented here explain, the theological manuscripts, along with many of the alchemical ones, still remain the last frontier, as it were, upon which a rising generation will now increasingly concentrate.

As this volume attests, Newton's theological and religious material has begun to yield its secrets to scholarly effort. We have here a sampling of the next generation of that scholarship. Predictably its trajectory is radically different from the characteristic work of 'the greats.' Theological issues are front and center, followed by the alchemical-chemical, and the ever persistent questions about Newton's legacy and complex influence into the eighteenth century, and beyond. The masters of the previous generation labored just to set Newton's historical chronology, to establish the ways and means of his mathematical and physical experiments and his natural philosophical insights. Now the focus has shifted, although the issue of getting his manuscripts into useable form remains as vital as it was back in the 1960s.

This volume also offers an account of past and present efforts to make all of Newton's legacy available to the world of historical research. Richard Popkin, fortunately for us one of the few of the greats still with us, and active, recounts the herculean efforts to find a funding source back at a time when the

very thought of Newton as theologian and alchemist was found to be repellant in some quarters. I was in the audience in the 1970s when Richard Westfall, speaking at one of the big international congresses in the history of science, presented his early work on Newton's alchemy. There were audible gasps, and under a barrage of hostile questioning, Westfall retorted in exasperation, "I did not write these manuscripts," or words to that effect. Very few in the audience wanted Newton to be a practicing alchemist, as well as a serious religious thinker.

The reluctance to accept Newton's alchemy and theology also was fed by the culture wars when the right could assume that anti-rationalist lefties were trying to debunk the founder of modern science. The Popkin-headed project to produce ten or more volumes of Newton's alchemical and theological manuscripts never got its funding, and I suspect that Dick is right when he sees the politics of the 1980s at work in the decision at the NEH (with assistance from the NSF) not to fund. The only good news to come out of that sad story arises from the change in format that time made possible as the digital revolution unfolded. As Rob Iliffe explains, putting Newton on-line electronically will permit an almost photographic reproduction of his reservations, crossing outs, jottings, ramblings and musings to be registered in a manner that print does not allow. A more authentic Newton can be seen on the web than on the printed page. The AHRB did the global world of scholarship immense good service when it provided the initial funding for the project now housed at Imperial College. Would that the American funding agencies had been as clear-sighted. We can only hope that private donors will now be more generous, and that the obvious quality of volumes such as this one will aid Imperial College in its fund-raising efforts.

Reevaluating Newton opens the whole of early modern intellectual history for reevaluation. Margaret Osler is surely right to stress that point, as did the volume she recently edited. It explored the question of what has happened to our understanding of the Scientific Revolution because we have changed so much of our understanding of its major figures, most notably, Newton himself.[1] In the late 1980s a split had occurred among the "greats" as to how to view the Scientific Revolution. Dobbs argued that it was a concept that had worn out its usefulness, while Westfall saw it as unproblematically self-explanatory, the central event of modernity. In Osler's earlier anthology, and in her essay in this volume, she recounts how we got to those contradictory positions, without perhaps, regrettably, telling us where she stands on the issue of *whether,* or *if,* a Scientific Revolution occurred. As with most concepts of this nature, the issue is one of definition. I believe that Jo Dobbs was wrong when she argued that because Newton practiced alchemy the whole historical construct of there

[1] Margaret J. Osler, ed., *Rethinking the Scientific Revolution* (Cambridge: Cambridge University Press, 2000).

having been a scientific revolution had been poorly conceived and incorrectly defined. The old positivist Newton is a dead duck, but the larger shift, one that made his alchemy an embarrassment and that mechanized the Western understanding of nature, still needs explaining, regardless of what Newton was reading and writing about in his rooms at Trinity. For better or worse, the modern emerged with one foot planted firmly on the back of what it labeled magic and superstition. From 1600 to 1750 a cultural shift as profound as any we have known occurred, and the appellation "scientific revolution," provided it is carefully nuanced, will do to begin a conversation about what happened within literate culture.

As a later essay in this volume by Lawrence Principe reminds us, what Newton was doing in his "laboratory" at Trinity is by no means transparent. Principe argues that Boyle's alchemy/chemistry is a whole lot clearer than Newton's, and he implies that Dobbs took too holistic an approach to the manuscripts, and hence to the argument that alchemy provided Newton with the crucial evidence for his concept of force. By holistic, I believe that Principe means that Dobbs wished to lump the manuscripts, to see coherence among them where he would split, and break them down as to their origin or pedigree. She also took a synthetic approach to Newton's alchemy, religiosity, and celestial dynamics, indeed she saw the categories themselves as inhibiting. Dobbs in *The Janus Face of Genius* had a deft appreciation for his religious sensibility, one that seemed to demand the kind of holism she embraced.

While I disagreed with Jo Dobbs about the issue of there having been a Scientific Revolution, as her friend and collaborator I also came to admire and endorse her vision of a unified Newton, held together by the fabric of his deep religiosity. It never occurred to me that Jo had much sympathy for Jungian ideas as Principe seems to find in her approach. Yet if she possessed some sort of religious core, however eccentric, did that perhaps not place her closer to her subject than more secularist scholars might hope to be? We need to know more about Newton's religion, and taking a look at the vast manuscript notes on the subject that Dobbs left behind and now stored at the University of California, Davis, might be one place to begin. Principe finds the effort by some feminist scholars to gender the mechanical philosophy male, and hence the alchemical, female, to be vastly overdone. He is undoubtedly right, but surely the baby is sliding along in the bath water when he tries to dismiss the association of some alchemical texts with Renaissance naturalism, and hence with vitalist, spirit-in-matter and heretical natural philosophies. Just like naturalism, alchemy had the potential to be intellectually subversive, as civil war radicals demonstrated when they took it up as but one of their many heresies. If we need to rethink Newton's alchemy, the larger seventeenth-century ideological context, particularly as presented by the English civil wars, must be preserved. So too, as the many eighteenth-century admirers of

Newtonian method would have told us, the point of a new analysis is to arrive at a new synthesis.

Newton's alchemy may belong in that dark nether world outlined by Rob Iliffe in his essay on prosecuting Athanasius, in a place in Newton's mind where bishops and kings could betray their believers, where little was sacred except a personal search for purity of heart and soul. Perhaps only long hours over the crucible made purity possible in a world where even priests could not be trusted and where, after 1660, alchemy along with all doctrinal deviation had been banned from public discourse. Indeed the survival of alchemy in the French academy of science after its establishment in 1666 offers dramatic testimony, by way of contrast, to the crushing effect of the fear induced in English intellectual life by the disorder of the 1650s. The retreat from all radical associations, and hence the suppression of alchemical talk—although not alchemical practice and the desire to reform medicine and science—gripped Boyle (b. 1632) and then Newton, and their many associates who back in the 1650s had thought a new order figuratively but moments away. We look long and hard at the proceedings of the Royal Society, founded in 1662, for evidence of any alchemical activities. Indeed only the scholarship of the last twenty years has revealed them, so carefully were they kept private.

By contrast, journey to Paris in the 1660s and alchemy is front and center in the early proceedings of the royally sponsored, Académie des Sciences. Meeting in private twice a week, one day to consider mathematics, the other physics, the company might seem very familiar to modern eyes. But its understanding of the natural world that set the agenda of what 'physics' meant in the 1660s in Paris was far closer to what we would call alchemy (as well as medicine.) The guiding spirits in matters experimental were two older naturalists, Gilles Personne de Roberval and Samuel Cottereau Duclos.[2] By 1668, a mere twenty-two investigators—of whom two, the famous Huygens and Cassini, were foreign but essentially expatriated in France—assembled in the King's Library to search the mysteries of nature. In texts to this day unpublished, Duclos laid out the terms and the language; it was essentially alchemical. True to the experimental tradition within alchemy, he wanted the company to find by means of "l'analyse chymique" the underlying substances that compose all natural mixes or combinations found in the world. "Three of these substances are as we would say essential, spirit (l'esprit), oil and salt because they participate in the essential virtues of *du Mixte* . . . that is mercury, sulphur, and salt (which has no other name.)" The three essential principles

[2] For biographical information on them, see the invaluable David J. Sturdy, *Science and Social Status. The Members of the Academie des Sciences, 1666–1750* (Rochester, NY: The Boydell Press, 1995), chap. 6. See also Allen G. Debus, *The French Paracelsians. The Chemical Challenge to Medical and Scientific Tradition in Early Modern France* (Cambridge: Cambridge University Press, 1991), p. 151, but updated by Sturdy.

are proclaimed by *les philosophes Hermetiques*, and together, but in ways that remain still mysterious, the three substances compose the Philosopher's Stone and it is the epitome of nature and the master of its arts. "Rightfully these three famous materials can be given the denomination of the *Principes Hermetiques*."[3]

Note that the fundamentals of nature in the Paris Academy of the 1660s, and beyond, are not the four elements of Aristotle, as was being taught down the road by the scholastics at the Sorbonne, but the three principles of Paracelsus. In the orations of Duclos to the newly assembled company we find alchemy at the heart of the intellectual life of the absolutist state. What a vastly different universe was inhabited by Boyle and Newton, a mere twenty two miles across the Channel, where some of their most cherished intellectual commitments had to be kept close to the chest, shared only with intimates, if at all. In retrospect, the political landscape being contoured by Louis XIV would turn out to be far less hospitable to the Newtons of the world than that engendered in England after 1689. But during the Restoration Boyle and Newton did not know what would come to pass in 1689. At the time caution and secrecy were good for them; bad for historians. After the Revolution, physics found security in the company of theology, and alchemy came to be seen as more quaint than subversive. In both France and England, Fontenelle helped the process along in the 1720s by writing an early history of the Paris Academy that wiped away any traces of alchemy, and by delivering a widely quoted eulogy on the death of Sir Isaac that made him seem modest, sweet, open, not the man you will meet in the pages that follow. Fontenelle's Newton never boiled salts in a crucible or thought long and hard about sin, his own or that of Athanasius.

Thirty years ago who could have imagined an essay on Newton and the devil? Such has now been given us by Stephen Snobelen who builds upon the early work of Frank Manuel. Assisted by vastly more manuscript material than what was available to Manuel, Snobelen argues that Newton denied the devil's existence, not to be a better deist, but rather to affirm the spirit of error and sinfulness at work deep in the human heart. Among the errors in need of extirpation was the whole corpus of Catholic intermediaries, saints, demons, and sundry evil spirits. Newton's position on the devil seems remarkably close to that of another, contemporary Calvinist, and doubter of spirits and witches, the Dutch minister, Bathazar Bekker. He wanted to banish the whole crowd so as to show the majesty of God.[4] Newton's hyper-Protestantism required a similar clearing of the haunted woods, an emptying of space that should

[3] *Archives de L'Académie royale des sciences, Procès-Verbaux*, vol. 1, *Registre de physique*, 22 Décembre 1666–Avril 1668, "Project d'Exercitations Physiques, proposé a l'assemblée, par le Sr. Du Clos," fols 3–5.

[4] Margaret C. Jacob, "The Crisis of the European Mind: Hazard Revisited," in Phyllis Mack and Margaret C. Jacob, eds., *Politics and Culture in Early Modern Europe. Essays in Honor of H .G. Koenigsberger* (Cambridge: Cambridge University Press, 1986), p. 261. Snobelen notes the similarity.

only be filled by the one, true God and his Word. Bekker's views caused a European-wide controversy, and Snobelen presents us with yet another reason why Newton was so secretive and closed. His penchant for unorthodoxy knew few boundaries, checked only by the strength of his Godliness. Of course banishing the devil did not preclude one's own mean-spiritedness, late in the seventeenth century or in the fourth century, as Rob Iliffe demonstrates in detail in his discussion of Athanasius and his Arian enemies, among them Isaac Newton. Early modern Christians talked to the ancients and identified with them while we now find just about everyone born before 1914 utterly strange and exotic. Knowing Sir Isaac's religiosity will be no easy matter, and it would be helpful to know exactly in what way the Restoration context seemed to make Athanasius a fitting target for Newton's secret antitrinitarian wrath as Iliffe, in passing, suggests.

As Scott Mandelbrote demonstrates, some contemporaries thought they knew Newton's inner thoughts to be heretical, and did not like what they saw. They were wise to the indiscretions entertained by the author of the great *Principia* and delighted in finding his errors. Rather than being intimidated by his reputation or his knighthood, critics of Newton after his death in 1727 smugly detailed the flaws in his chronology, his translations, and hence in his theology. First Newton was proclaimed an Anglican hero, his science the foundation of natural religion—so said Richard Bentley at the Boyle Lectures in 1691–2—and then Newton's theology and chronology were pilloried at the Lady Moyer's lectures given at St. Paul's Cathedral in 1728–29. The clerical worm could turn, even on Sir Isaac. But in the end he outsmarted them all by his reticence to publish.

Newton's unorthodoxy remained almost an underground tradition cherished by Unitarians such as Joseph Priestley, but easily ignored by devout Anglicans. It was only in the 1790s, in the wake of the French Terror, as Larry Stewart explains, that the high-church led by Edmund Burke really turned up the temperature on the whole enterprise of experimental science and what was seen to be its radical associations. In the course of the eighteenth century, Newtonianism took a multitude of forms and this volume has attempted to examine only a few of its many incarnations. In France, as we shall see, getting universal gravitation accepted in the academies and taught in the colleges entailed an uphill struggle against the Jesuits, among others. By contrast, in England and Scotland the victory was swift. By 1710, the universities and Dissenting academies taught the *Principia* and *Opticks* although there was always a high-church vs. low-church split, with the latter more eager to promote Newtonian ideas and methods. Freethinkers and republicans, led in Newton's life time by John Toland, had their Newton too. Again, as we find in Larry Stewart's essay, by the third generation of Newtonian scientists (Thomas Beddoes, James Watt, and Joseph Priestley), the association which they forged between the master's legacy and radical politics—support for the American Revolution

and for the early phase of the French upheaval—almost undid nearly a century of respectability. It was as if the Boyle lecturers had toiled in vain. By the early nineteenth century, chemistry was in disfavor at Oxford precisely because of its radical associations, and much of the whitewashing of Newton's thought came out of that same reactionary period.

The subsequent nineteenth-century effort to idealize and make positivist the contributions of science may have contributed to an historical amnesia, still with us in some quarters, about the deeply applied and practical side of Newtonian mechanics. Just when Burke railed against the dangers and infidelities promoted by the philosophers, the work of the engineers schooled in Newtonian mechanics came to fruition. By the 1790s, the industrial genie was out of the bag. The application of mechanics to everything from steam to cotton, and thus the formation of a first knowledge-based economy, had commenced in earnest.[5] None of this could have been foreseen, or remotely desired, by Newton himself. If the scholarship of the past forty years, including the essays presented here, has taught us anything, it is how deeply uninterested Newton had been in worldly application. He never ventured forth to shop floor or river bank with any of the devices he used to illustrate the earthly workings of the principles he knew to be present amid the heavenly bodies. The words in his Bible had more concrete meaning—although there like all good Protestants he was selective—than did the levers, weights, and pulleys that illustrated the laws of motion.

In choosing to have their Newton as they wanted him, eighteenth-century heretics and Christians alike ignored Newton's Biblical literalism. By then such literalism had all but disappeared among the educated. As James Force shows in his paper here, the same Newton who thought that demons were metaphors for sin, believed in the six, exactly six, days of creation. Force then explains how Newton held his miracles and his general laws of nature in synthesis in the same mind. As he wisely notes, today we have far more trouble with this reconciliation than did Newton, or most of his Newtonian associates. They attempted "to retain both a generally and a specially provident—interventionist, miracle-working—deity."

A knowledge of Newton's theology illuminates the early modern European mind profoundly, but now we must ask, does it get us closer to understanding the wellspring of the Western investigation into nature precisely at that same moment? Suppose Newton was not a voluntarist; suppose he was? Put another way, suppose he thought that nature had to work in certain ways, and not others, and that God's intellect made his will conform to the reason of it all? Or, suppose his will made nature be one way, at least for the time being, until

[5] See Margaret C. Jacob and Larry Stewart, *Practical Matter. The Application of Newtonian Science from 1687 to 1851* (Cambridge, Mass.: Harvard University Press, forthcoming, 2004); cf. Joel Mokyr, *The Gifts of Athena* (Princeton: Princeton University Press, 2002).

this system wanted a reformation, to paraphrase Newton, and another set of laws might be born? Do either of these quite different theological positions make a difference for our understanding of why Newton, or any of the early modern greats, chose to spend much of their lives in the study of nature? Peter Harrison's provocative paper flies in the face of the received wisdom about Newton's voluntarism. It even contradicts the position taken in this volume in the paper of James Force. But would either position alter our understanding of why Newton did philosophy and mathematics with such ardor? Could he have been trying to come to some kind of peace around an issue that was deeply vexed? If God bent his will to the order of nature, did that not imply a free-standing nature, and endorse the very atheism that Newton, Boyle, Barrow, and the Cambridge Platonists so dreaded? These are questions that now need to be asked, and answered, especially by those who would argue against Newton as a secure voluntarist.

In the generations after Newton, his European admirers did not so much care why he had done science, but rather that he had done it with such brilliance. Accepting his conclusions and moving on, provoked wide social and ideological tensions in Catholic France. The issue revolved around the power of the Jesuits and their influence in the educational institutions and academies. As Sarah Hutton explains, one circle in particular led the fight against them, and Emilie du Châtelet, Voltaire, and Maupertius were at its heart just as they were deeply entwined personally. Modern scholarship, often informed by feminism, has cut through the nonsense about Du Châtelet, and she has been restored to her place as the premier explicator of the *Principia*. So, too, the wily Italian popularizer, Count Francesco Algarotti, deserves a place in the Continental Newtonian camp. As presented by Hutton, all are embattled but slightly above the fray. One wonders what Du Châtelet made of Algarotti's anti-clericalism as it shines through the pages of his Newtonianism for the ladies (*Newtonianismo per le dame*, 1737.) Did she privately share it, even if she found Algarotti's version of the master's great philosophy frivolous? It would be interesting to know Sarah Hutton's reaction to Mary Terrall's new book on Maupertius. Terrall sees Maupertius as a philosophical pioneer to be sure, but also in some ways as much a creature of influence and prestige as the clergy with whom he did battle who was caught in the web of the French academic system and the need for constant social advancement. As Terrall puts it, Maupertius's "commitment to the natural philosophy of gravity cannot be separated either from his desire to spearhead a distinctively French Newtonian physics . . . or from his personal ambition."[6] Men and women of independent means such as Voltaire and Du Châtelet may have had it far easier

[6] Mary Terrall, *The Man Who Flattened the Earth: Maupertius and the Sciences in the Enlightenment* (Chicago: University of Chicago Press, 2002), p. 171. This book would not have been available when Sarah Hutton wrote her essay.

than Maupertius, Algarotti, and Clairaut for whom seeking place had to be unrelenting. Turning the tide against Aristotle and Descartes was a far slower process in Catholic than in Protestant Europe, and all the more slow where court and church patronage counted for so much. We are reminded of the low esteem with which Newton held the Catholic clergy, and we may even take a certain secret pleasure in knowing how sure he would have been that they meant him and his philosophy nothing but ill will.

The Newton that emerges from the pages that follow may be less 'in focus' than the image inherited from the magisterial scholars of the previous era. Religion and theology remain central to his intellectual makeup, but now contradictions begin to appear. How can a Biblical literalist also dismiss the existence of the devil? If Newton's alchemy lacks a religious motive, why was he doing it? Or was he doing it for as many hours, for as much of his time as we have been assuming? Did he retreat into mathematics for certainty in the face of theological and historical pursuits of daunting complexity, where certain answers were few and far apart? Did Newton assign a status to his various pursuits, or was it all an equivalent labor, unified by the holistic enterprise of finding the traces of God's work in all of creation? And, not least, does the eighteenth-century approach to Newton common among the Scottish philosophers, make more sense than our own? Larry Stewart quotes them as imagining Newton as tranquil, his legacy secure, with only his methods and achievements mattering for posterity. After the dust settles on all those manuscripts, their transcriptions scanned for all to see on the world-wide web, will the new synthesis begin to look remarkably like theirs? Yes, he was an alchemist who talked to Athanasius venomously as if he were alive and well; yes, he probably thought the Catholic Church had invented the devil to cover its own wickedness, but in the end we are still drawn first and foremost to his equations and laws. They set the standard of how hard anyone must work to ever know anything worthwhile about the world. We are so fortunate to have the scholars you are about to read. They aim to replicate the standards put in place by masters of Newtonian scholarship who flourished in the previous generation and whose passing (in some cases quite recently) we note in order to commemorate.

ESSAY 1

The New Newtonian Scholarship and the Fate of the Scientific Revolution

MARGARET J. OSLER
University of Calgary

> Distorted reality is as dust, though the truth be infinitely complex and beyond our present knowledge. Let us therefore try to appreciate the man in his own terms rather than as a prop to our scheme of things.[1]

Isaac Newton's contribution has played a key role in the historical interpretation of early modern natural philosophy. The dominant tradition of twentieth-century scholarship developed around the idea of the Scientific Revolution. Because Newton's accomplishments were seen as the culmination of that great historical episode, changes in the understanding of his work have profound implications for the interpretation of the intellectual history of that period. Recent developments in Newtonian scholarship—particularly the serious study of his theological and alchemical interests—have thus played a significant role in re-evaluations of that important historiographical concept, the Scientific Revolution.

The traditional account of the Scientific Revolution was deeply influenced by nineteenth-century positivist assumptions that privileged mathematical physics.[2] Consequently, astronomy, mathematics, and physics became the focus of discussions of the Scientific Revolution.[3] According to this account, the Scientific Revolution began when Copernicus proposed a heliocentric

[1] D. T. Whiteside, "The Expanding World of Newtonian Research," *History of Science* 1 (1962), p. 27.
[2] See Auguste Comte, *Cours de philosophie positive*, 6 vols (Paris, 1830–42), 1:47–95.
[3] Classic accounts include A. Rupert Hall, *The Revolution in Science, 1500–1750* (London: Longman, 1983; first published 1954); Richard S. Westfall, *The Construction of Modern Science: Mechanisms and Mechanics* (New York: John Wiley, 1971); and Charles Coulston Gillispie, *The Edge of Objectivity: An Essay in the History of Scientific Ideas* (Princeton: Princeton University Press, 1970); and, more recently,

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 1–13.
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system to replace the Ptolemaic astronomy that had held sway since the second century A.D. Because Copernicus and his followers advocated a realist interpretation of their heliocentric astronomy, the new system challenged Aristotelian cosmology, which was explicitly geocentric and geostatic. The new astronomy thus raised perplexing questions about physics: why do unattached objects not fly off the surface of a moving earth? What holds the planets in their orbits? The working out of the answers to these questions through the contributions of Kepler, Galileo, Descartes, and Newton is considered the heart of the Scientific Revolution. According to Alexandre Koyré, probably the most influential thinker about such subjects in mid-century, we can:

> characterize this revolution by two closely connected and even complementary features: (a) the destruction of the cosmos, and therefore the disappearance from science—at least in principle, if not always in fact—of all considerations based on this concept, and (b) the geometrization of space, that is the substitution of the homogeneous and abstract—however now considered as real—dimensions of space of the Euclidean geometry for the concrete and differentiated place-continuum of pre-Galilean physics and astronomy.[4]

Koyré maintained that Newtonian concepts of matter, motion, space, and attraction formed a synthesis that culminated in the mathematization of nature and therefore of science, thus answering the unsolved problems raised by heliocentric astronomy and completing the revolution that Copernicus had begun.

Koyré's account of Newton's role as the culmination of the Scientific Revolution became the clarion call for the interpretation that dominated the 'Newton Industry' that developed in the1960s as many scholars began to give serious attention to the Portsmouth Papers. Several fundamental textual projects were undertaken during this period, including the publication of Newton's correspondence, Whiteside's edition of Newton's mathematical papers, and the publication of a variorum edition of the *Principia*.[5] As scholars began to study the wealth of manuscript and printed material by and about Newton, they concentrated on his work in physics and mathematics.

Peter Dear, *Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500–1700* (Princeton: Princeton University Press, 2001).

[4] Alexandre Koyré, "The Significance of the Newtonian Synthesis," in Alexandre Koyré, *Newtonian Studies* (Cambridge, Mass.: Harvard University Press, 1965), pp. 6–7. This essay was first delivered as a lecture in 1948 and published in *Archives internationales d'histoire des sciences 3* (1950), pp. 291–311, and reprinted in *Journal of General Education* 4 (1950), pp. 256–68.

[5] Isaac Newton, *The Mathematical Papers of Isaac Newton*, edited by Derek T. Whiteside with the assistance of M. A. Hoskin, 8 vols. (Cambridge: Cambridge University Press, 1967–1980); Isaac Newton, *The Correspondence of Isaac Newton*, edited by H.W. Turnbull, J. P. Scott, A. R. Hall, and Laura Tilling, 7 vols. (Cambridge: Published for the Royal Society at the University Press, 1959–1977); and Isaac Newton, *Isaac Newton's Philosophiae naturalis principia mathematica. The Third Edition (1726) with Variant Readings*, ed. Alexandre Koyré and I. Bernard Cohen with the assistance of Anne Whitman, 2 vols. (Cambridge, Mass: Harvard University Press, 1972).

Writing in 1962, Derek Whiteside surveyed the impact of the opening of the Portsmouth Collection in the University Library, Cambridge.[6] Whiteside focused on Newton's mathematical papers, to the exclusion of almost everything else. Despite his call to understand Newton in his own terms, Whiteside uncritically imposed the terminology of modern science onto Newton's career. For example, he praised "The recent research of A.R. and Marie Boas Hall . . . into the experimental aspects of Newton's molecular physics, chemistry, and alchemy and their incomplete synthesis into a consistent pattern of thought . . . ."[7] He identified topics that needed further study, including the structure and development of the *Principia*, Newton's optical achievements, and his mathematics, including a study of the Newton-Leibniz priority dispute. And, not surprisingly as their future editor, he called for the publication of Newton's mathematical papers. Whiteside's Newton was, by and large, the creator of the mathematical physics of the *Principia* and the experimenter of the *Opticks*. Echoing his own words first written in 1960, I. Bernard Cohen pronounced that:

> The Newtonian revolution in the sciences was wrought by and revealed in the *Principia*. For more than two centuries, this book set the standard against which all other science was measured; it became the goal toward which scientists in such diverse fields as paleontology, statistics, and biochemistry would strive in order to bring their own fields to a desired high estate.[8]

Similarly, Richard S. Westfall saw Newton's accomplishments in physics as the culmination of the Scientific Revolution. In a statement obviously influenced by Koyré, Westfall wrote:

> Not only was Newton's achievement monumental, so that it stands as one of the supreme accomplishments of the human intellect, but it also drew together the principal strands of seventeenth-century science, solving major problems left unresolved by the scientific revolution.[9]

On the basis of his close analysis of Newton's work in physics, Westfall wrote an important book on the history of seventeenth-century dynamics, in which he argued for the profound significance of Newton's concept of force as the crowning principle of the Scientific Revolution.[10]

[6] Whiteside, "The Expanding World of Newtonian Research," pp. 16–29.

[7] Ibid., p. 18.

[8] I. Bernard Cohen, *The Newtonian Revolution: With Illustrations of the Transformation of Scientific Ideas* (Cambridge: Cambridge University Press, 1980), p. 16. Cohen used almost the same words twenty years before. See his *The Birth of a New Physics*, revised and updated (New York: Norton, 1985; first published 1960), Chap. 7.

[9] Westfall, *The Construction of Modern Science*, p. 139.

[10] Richard S. Westfall, *Force in Newton's Physics: The Science of Dynamics in the Seventeenth Century* (London and New York: MacDonald and American Elsevier, 1971).

To the extent that this generation of scholars discussed manuscripts in which Newton considered topics alien to the interests of twentieth-century science, they tried to fit them into a modern scientific framework.[11] Writing about Newton's preoccupation with alchemy and chemistry, Marie Boas wrote:

> Newton's extraordinary achievements in physics have understandably overshadowed his chemical work: it is fortunate that the sale some years ago of his large collection of alchemical books and notes forced a renewed consideration of his overt preoccupation with alchemy, which in turn has led to the study of his place in the history of chemistry. He has been found to have been a skilled, original, and painstaking chemist with a wide and profound influence.[12]

Reading this material entirely in terms of the assumptions of modern, experimental science, Boas continued:

> Even a cursory glance at Newton's chemical papers indicates that his approach to chemical problems was not that of an alchemist. His explanations are in the language and spirit of experimental natural philosophy, quite different from the usually cloudy and often mystic views of the alchemists whose works he bought or borrowed so avidly, as he did all books that had any pretensions to dealing with chemical theory or practice.[13]

This blanket dismissal of any possibility that Newton took alchemy seriously, despite massive manuscript evidence to the contrary, is the result of deeply held convictions that the scientific disciplines were the same in the seventeenth century as they were in the mid-twentieth and that the historical actors should be judged by the same methodological standards as their modern counterparts.

Similarly, anachronistic assumptions marked earlier discussions of Newton's vast theological output. Lamenting the rise of materialism and positivism in the early twentieth century, E. A. Burtt believed that Newton reduced the deity to one of a number of metaphysical entities comprising the world:

> Newton thus apparently takes for granted a postulate of extreme importance; he assumes, with so many others who bring an aesthetic interest into science, that the incomparable order, beauty, and harmony which characterizes the celestial realm in the large, is to be eternally preserved. It will not be preserved by space, time, mass, and ether alone; its preservation requires the continued exertion of that divine will which freely chose this order and harmony as the ends of his first creative toil. From the Protoplast of the whole, God has now descended to

[11] For an account of past treatments of Newton's alchemical writings, see B. J. T. Dobbs, *The Foundations of Newton's Alchemy or, 'The Hunting of the Greene Lyon'* (Cambridge: Cambridge University Press, 1975), pp. 6–20.

[12] Marie Boas, in *Isaac Newton's Letters and Papers on Natural Philosophy*, ed. I. Bernard Cohen with the assistance of Robert Schofield (Cambridge, Mass.: Harvard University Press, 1958), p. 241.

[13] *Isaac Newton's Letters and Papers on Natural Philosophy*, p. 243.

> become a category among other categories; the facts of continued order, system, and uniformity as observed in the world, are inexplicable apart from him.[14]

Burtt based his impoverished interpretation of Newton's theology on Newton's published, 'scientific' works, thus overlooking Newton's passionate concern with the doctrine of the Trinity and the fulfillment of the prophecies that later scholars have found both vexing and revealing.[15]

In a relatively early analysis of Newton's manuscripts, a young Westfall declared that Newton, "writing at the end of the seventeenth century, . . . fell heir to a traditional concern with natural religion that flourished among the earlier leaders of the scientific movement in England."[16] He saw Newton's concern about natural religion as a response to Hobbes whose "writings had raised the possibility that mechanical philosophy might conclude in atheism."[17] To this end, Westfall argues, Newton, like Robert Boyle and John Ray, conceived of natural religion as "the rationally demonstrated foundation upon which the revealed superstructure of Christianity rested securely."[18] For Westfall, one of the most articulate defenders of the concept of the Scientific Revolution, Newton's heterodox, rational Christianity revealed the impact of "the new science" on religion.[19] Westfall maintains that:

> The impact of science upon Christianity may also be traced in the virtuosi's picture of God. While they asserted the harmony of science and religion, they were bending their conception of God to fit into their scientific universe, until with Newton the Father was fading into a metaphysical projection of the creation. The nature of God was adjusted to the nature of the universe as science revealed it.[20]

A deeper analysis of the meaning of Newton's theology had to await serious examination of the full range of manuscript evidence, in particular the vast Yahuda Collection held in Jerusalem. Frank E. Manuel undertook one of the first analyses of this material, but his approach remained in the thrall of the traditional historiography of the Scientific Revolution. Manuel pursued a line similar to Westfall's in finding a methodological consonance between Newton's theological and scientific work:

[14] Edwin Arthur Burtt, *The Metaphysical Foundations of Modern Physical Science*, revised edition (Garden City, N.Y.: Doubleday, 1954; first published 1924), pp. 296–7.

[15] Burtt, *The Metaphysical Foundations of Modern Physical Science*, p. 338.

[16] Richard S. Westfall, "Isaac Newton: Religious Rationalist or Mystic?" *The Review of Religion* 22 (1957), p. 167.

[17] Ibid.

[18] Westfall, "Isaac Newton: Religious Rationalist or Mystic?" p. 168.

[19] For a concise statement of Westfall's account of the Scientific Revolution, see Richard S. Westfall, "The Scientific Revolution Reasserted," in Margaret J. Osler, ed., *Rethinking the Scientific Revolution* (Cambridge: Cambridge University Press, 2000), pp. 41–55.

[20] Richard S. Westfall, *Science and Religion in Seventeenth-Century England* (New Haven, Conn.: Yale University Press, 1958), p. 199.

> Newton's statement of fundamental religious principles, his interpretation of prophecy, his textual criticism of the historical works of Scripture, his system of world chronology, his cosmological theories, and his euhemereistic reduction of pagan mythology all bespeak the same mentality and style of thought. If nature was consonant with itself, so was Isaac Newton's mind. At the height of his powers there was in him a compelling drive to find order and design in what appeared to be chaos, to distil from a vast, inchoate mass of materials a few basic principles that would embrace the whole world and define the relationships of its component parts. Newton could not rest content with merely contemplating the sheer variety and multiplicity of historical events, any more than he could a world of disparate observations about nature.[21]

In addition to seeing Newton's religion as methodologically similar to his science, Manuel interpreted Newton's drive for methodological unity in psychoanalytic terms:

> All of Newton's studies were animated by one overwhelming desire, to know God's will through His works in the world. For myself, I have come to believe that the fervour of Newton's quest for knowledge of God was related . . . to a psychic quest for his own father.[22]

Not only was Manuel's interpretation of Newton's theology informed by his assumption of Newton's place in the Scientific Revolution, but he foreclosed any serious discussion of the early modern meaning of that theology by reducing it to Newton's psychology, interpreted in anachronistic, Freudian terms.

During the 1960s and '70s, the Newton industry prospered and was a dominant presence in the journals and conferences devoted to the history of science. A number of scholars, including the Halls, John Herivel, I. B. Cohen, Richard S. Westfall, and from the mid 1970s Alan Shapiro—as if taking up Whiteside's challenge—explored the nooks and crannies of the technical side of the *Principia* and *Opticks*. The Portsmouth Collection, the Keynes Collection at King's College, Cambridge, and Newton's letters provided a cornucopia of material leading to new insights into the development of Newton's ideas about mechanics and optics. Westfall characterized this period of Newton scholarship in the following terms:

> While production of Newtoniana is not confined to a cartel, a fairly small group dominates the industry in quantity. They constitute a claustrophobic and neurotic society, the members of which circle each other warily, jockeying for position, each of the others with one eye cocked on the Lord High Executioner, D. T. Whiteside, who stands at the center, beta function in one hand, citation from *Add. MS.* 3965.12, f.186 *recto* in the other, striving with indifferent success to maintain law and order.[23]

[21] Frank E. Manuel, *The Religion of Isaac Newton* (Oxford: Clarendon, 1974), p. 103.

[22] Ibid.

[23] Richard S. Westfall, "The Changing Wolrd of the Newtonian Industry," *Journal of the History of Ideas* 37 (1976), p. 175, n. 2.

Westfall noted that "the Newton of . . . [Whiteside's edition of Newton's] *Mathematical Papers* is the Newton we have always known . . . . [H]e is still the progenitor of the tradition of mathematical physics, that and nothing more."[24] Law and order, however, was already being subverted by serious scholarly attention to Newton's alchemy and theology.

Although earlier scholars, such as the Halls and Westfall, had noted the wealth of Newton's manuscripts, they did so selectively, concentrating on materials that seemed relevant to later scientific developments. It came to be recognized that Newton did not share the intellectual agenda of his twentieth-century commentators, as scholars began taking account of the mass of materials he left on theological and alchemical subjects and to situate him within the context of a European natural philosophical community in which such interests were widely shared.[25]

The interest in alchemy contributed to a radical reinterpretation of Newton's work. P. M. Rattansi and J. E. McGuire took an early and important step in recognizing that Newton's intellectual agenda was markedly different from our own. Their seminal paper, "Newton and the 'Pipes of Pan'."[26] was one of the first scholarly studies of the "other" Isaac Newton. They concluded their study of Newton's deep concern with the *prisca theologia* by remarking that:

> It is certainly difficult for us in the twentieth century to conceive one whose scientific achievements were so great, pursuing with equal interest and energy such other studies, especially when his efforts in those fields produced so little of enduring value. It is even more difficult for us to imagine the mechanics and cosmology of the *Principia* being influenced by Newton's theological views and his belief in a pristine knowledge. Sir Isaac Newton, however, was not a 'scientist' but a Philosopher of Nature. In the intellectual environment of his century, it was a legitimate task to use a wide variety of material to reconstruct the unified wisdom of Creation.[27]

By highlighting the importance of the *prisca* tradition for Newton, Rattansi and McGuire situated him within the broader context of Renaissance humanism and its appeal to ancient sources.

Newton's interest in subjects lying outside the domain of modern science was extensive. He was preoccupied with alchemy for most of his life.

[24] Ibid., p. 177.

[25] This is not the first time that historians have emphasized the importance of these traditions for the development of early modern natural philosophy. Pioneering works include Yates, *Giordano Bruno and the Hermetic Tradition* (Chicago: University of Chicago Press, 1964); Paolo Rossi, *Francis Bacon, From Magic to Science*, trans. Sacha Rabinovitch (London: Routledge and Kegan Paul, 1968; first published in Italian, 1957); Allen G. Debus, *The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries*, 2 vols (New York: Neale Watson, 1977); and Charles Webster, *From Paracelsus to Newton: Magic and the Making of Modern Science* (Cambridge: Cambridge University Press, 1982).

[26] J. E. McGuire and P. M. Rattansi, "Newton and the 'Pipes of Pan'," *Notes and Records of the Royal Society of London* 21 (1966), pp. 108–43.

[27] Ibid., p. 138.

B. J. T. Dobbs' groundbreaking book, *The Foundations of Newton's Alchemy or, "The Hunting of the Greene Lyon"*, was the first comprehensive, scholarly analysis of his alchemical manuscripts,[28] and Richard S. Westfall fully incorporated this material into *Never at Rest*, his magisterial biography of Newton. Although it is true that Westfall was willing to countenance Newton's alchemy, he understood it within the context of his 'scientific' work, never considering that Newton's alchemical obsessions might provide a clue to the meaning of his work in physics. "The significance of alchemy in his intellectual odyssey lay in the broader vistas it opened to him, additional categories to supplement and complete the narrow mechanistic ones. His enduring fame derived from his seizing the possibilities thus spread before him."[29] Moreover, Westfall attempted to show that Newton's approach to alchemy paralleled the method he used in his more purely scientific work. Dobbs pushed the argument further, demonstrating that in contrast to the nineteenth- and twentieth-century view that places mathematical physics at the pinnacle of intellectual merit, Newton understood his life's work, which included tireless devotion to alchemy, "as a study of the modes of divine activity in the world."[30] His God, as James E. Force has argued, is "the Lord God of Dominion," and his voluntarist theology bound the diverse aspects of his thought into a coherent whole.[31] McGuire later underscored these connections in an exegetical *tour de force* in which, assuming Dobbs's redating of *De gravitatione* to the period just prior to the publication of the *Principia*, he demonstrated the importance of theology to Newton's physics.[32] A new generation of historians is now teaching us that to grasp the significance of Newton's physics or the meaning of his preoccupations with alchemy and theology we must acknowledge how deeply embedded what we call his scientific work was in his fundamentally theological quest.[33] If we insist, as the fathers of the Scientific Revolution did, on privileging Newton's mathematical physics and optics because those are the aspects of his thought that have prevailed in the end, we lose our hold on the concerns of the historical actor himself.

[28] Dobbs, *The Foundations of Newton's Alchemy*. See Note 11 for publication data.

[29] Ibid., p. 301.

[30] B. J. T. Dobbs, *The Janus Faces of Genius: The Role of Alchemy in Newton's Thought* (Cambridge: Cambridge University Press, 1991), p. 18.

[31] James E. Force, "The Nature of Newton's 'Holy Alliance' between Science and Religion: From the Scientific Revolution to Newton (and Back Again)," in Margaret J. Osler, ed., *Rethinking the Scientific Revolution*, pp. 247–70.

[32] J. E. McGuire, "The Fate of the Date: The Theology of Newton's *Principia* Revisited," in Margaret J. Osler, ed., *Rethinking the Scientific Revolution*, pp. 271–95.

[33] "Newton's thought is a seamless unity of theology, metaphysics, and natural science. Newton's view of God's Dominion, i.e., the total supremacy of God's power and will over every aspect of creation, colors every aspect of his views about how matter (and the laws regulating the ordinary operation of matter) is created, preserved, reformed, and occasionally interdicted by a voluntary and direct act of God's sovereign will and power." James E. Force, "Newton's God of Dominion: The Unity of Newton's Theological, Scientific, and Political Thought," in *Essays on the Context, Nature, and Influence of Isaac Newton's Theology*, James E. Force and Richard H. Popkin, eds. (Dordrecht: Kluwer Academic, 1990), p. 84.

Two collections of articles exemplify these changes in Newton historiography. The first is a volume celebrating the 300th anniversary of Newton's *annus mirabilis*, edited by Robert Palter and published in 1966.[34] The second is a volume of papers entitled *Newton and Religion*, edited thirty-three years later by James E. Force and Richard H. Popkin.[35] Interestingly, both volumes are based on study of newly (at the time) studied sets of Newton manuscripts. Yet the differences between the two volumes could hardly be greater.

The 1966 volume provides a snapshot of the state of the Newton industry of the period. Its longest section is entitled "Newton's Scientific Achievements" and contains articles by Rupert and Marie Hall on Newton's theory of matter, by Asger Aaboe on his mathematics, by Richard S. Westfall on Newton's theory of thin films, I. Bernard Cohen on the concept of force in the *Principia*, and Clifford Truesdell on the *Principia*'s influence on later mechanics. These authors took for granted the traditional historiography of the Scientific Revolution, a concept that received no explicit discussion. There are also sections on Newton's life, on his influence, and on the philosophical analysis of his scientific achievements. The papers are full of mathematical formulae. Most of these papers jump right into technical discussions of Newton's concepts and reasoning, assuming that the audience would understand their broader intellectual and historical significance. They read almost as if there were no historiographical debate at all. Newton's prominence as the superstar of the Scientific Revolution and the founder of modern experimental and mathematical science is simply unquestioned. The index contains no references to alchemy, only a single reference to Arianism (in a commentator's comments), and only a few references to Newton's anti-Trinitarianism. Because these topics did not seem to pertain to the development or nature of modern physical science, there was no reason to include them in these discussions.

Thirty-three years later, the cast of Newtonian scholars has, predictably, changed. Instead of the historians who crafted the historiography of the Scientific Revolution, we find a younger generation of scholars devoted to a very different set of issues: Newton's alchemy and eschatology,[36] his views on reading the Book of Nature,[37] his anti-Catholicism,[38] his theology,[39] his

[34] Robert Palter, ed., *The Annus Mirabilis of Sir Isaac Newton, 1666–1966* (Cambridge, Mass.: MIT Press, 1966).

[35] James E. Force and Richard H. Popkin, eds, *Newton and Religion: Context, Nature and Influence* (Dordrecht: Kluwer, 1999).

[36] D. E. Harkness, "Alchemy and Eschatology: Exploring the Connections between John Dee and Isaac Newton," in Force and Popkin, eds, *Newton and Religion*, pp. 1–15.

[37] J. J. Bono, "From Paracelsus to Newton: The Word of God, the Book of Nature, and the Eclipse of the 'Emblematic World View'," in Force and Popkin, eds, *Newton and Religion*, pp. 45–76.

[38] R. Iliffe, "Those 'Whose Business It Is To Cavill': Newton's Anti-Catholicism," in Force and Popkin, eds, *Newton and Religion*, pp. 97–119.

[39] M. Goldish, "Newton's *Of the Church*: Its Contents and Implications," in Force and Popkin, eds, *Newton and Religion*, pp.145–64; K. J. Knoespel, "Interpretive Strategies in Newton's *Theologiae gentiles origenes philosophiae*," in Force and Popkin, eds, *Newton and Religion*, pp. 179–202; G. A. J. Rogers,

search for divine activity in the world, and his Christology.[40] Although they do not dismiss Newton's scientific achievements, they portray him as an anti-Trinitarian Millenialist, obsessed with theology and devoted to alchemy. Their Newton consulted the Church Fathers and clandestine alchemical manuscripts as well as the Book of Nature; and he was at least as concerned with divine power as with gravitational force. If Newton—the culminating figure of the Scientific Revolution—turns out to have been preoccupied with issues so disparate from those lurking behind Charles Gillispie's image of "Newton with his Prism and Silent Face,"[41] it seems prudent to re-examine the old story, to explore more carefully the intellectual concerns of his contemporaries and predecessors and so to re-examine the assumptions historians have imposed on their subject matter.

Because historians of science have interpreted Newton's work as the climax of the narrative they call the Scientific Revolution, this radical shift in our understanding of the meaning of his own work, forces us to reconsider many of the received opinions about the nature of the Scientific Revolution. Studies of Newton are no more an isolated phenomenon of scholarship than was he a man isolated from the main currents of European intellectual history. Recent studies situate Newton in the broad intellectual currents of his time. They also bring to light a number of unexamined presuppositions about the cast of individuals who played an active role in the Scientific Revolution and about the canonical disciplines themselves.

Reading Newton in light of his own preoccupations rather than those of twentieth-century historians raises questions about the applicability of twentieth-century disciplinary boundaries to seventeenth-century intellectual history. Historians have privileged Newton's mathematical physics because that is the field of greatest prominence in their intellectual world.[42] Newton, however, would have described himself as a natural philosopher. Indeed, he entitled his great masterpiece *Mathematical Principles of Natural Philosophy*.[43] The early modern term "natural philosophy" had a different extension from the modern term "science", encompassing God's creation of the world, his providential relationship with the creation, and the immortality of the soul along with the chemistry, physics, anatomy, and physiology that we would

"Newton and the Guaranteeing God," in Force and Popkin, eds, *Newton and Religion*, pp. 221–35; James E. Force, "Newton on the 'Ancients' and the 'Moderns'," in Force and Popkin, eds, *Newton and Religion*, pp. 237–57.

[40] S. Hutton, "The Seven Trumpets and the Seven Vials: Apocalypticism and Christology in Newton's Theological Writings," in Force and Popkin, eds, *Newton and Religion*, pp. 165–78.

[41] Gillispie, *The Edge of Objectivity*, title of Chap. 4.

[42] See, for example, Richard S. Westfall, "The Scientific Revolution Reasserted," in Margaret J. Osler, ed., *Rethinking the Scientific Revolution*, pp. 41–55.

[43] See Andrew Cunningham, "How the *Principia* Got Its Name: Or, Taking Natural Philosophy Seriously," *History of Science* 29 (1991), pp. 377–92.

expect. Natural philosophers did not establish criteria of demarcation between these issues and what we consider genuine scientific concerns, but regarded them as inseparable.[44]

Taking natural philosophy seriously as the subject-matter of concern to early modern thinkers leads to a significant departure from the nineteenth-century, Positivist assumption that modern science could only emerge after there existed a sharp demarcation between science and religion, and that this crucial separation took place during the Scientific Revolution. Recent scholarship has demonstrated that no such separation occurred, at least not during the seventeenth century. Kepler, Gassendi, Boyle and many others shared Newton's concern with theological issues, among them questions about the immortality of the soul, the role of divine providence in the world, and millenarian ideas.[45] Similarly, many traditional ideas—such as that of final cause—which historians have repeatedly told us had been purged from 'the new science'[46] continued to play an important role for these thinkers.[47]

This sea-change in our understanding of Newton raises important questions. How are we as historians to relate the various facets of Newton's intellectual

[44] This fact directly contradicts Brian Vickers' attempt at drawing demarcations. See "Introduction" in Vickers, ed., *Occult and Scientific Mentalities in the Renaissance*. For evidence of the inseparability of what we would call "magic," "science," and "religion," see Amos Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century* (Princeton, N.J.: Princeton University Press, 1986); Margaret J. Osler, *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World* (Cambridge: Cambridge University Press, 1994); and Dobbs, *Janus Faces*.

[45] See, for example, Peter Barker, "The Role of Religion in the Lutheran Response to Copernicanism," in Margaret J. Osler, ed., *Rethinking the Scientific Revolution*, pp. 59–88; Margaret J. Osler, *Divine Will and the Mechanical Philosophy*; James E. Force and Richard H. Popkin, eds, *The Millenarian Turn: Millenarian Contexts of Science, Politics, and Everyday Anglo-American Life in the Seventeenth and Eighteenth Centuries* (Dordrecht: Kluwer Academic Publishers, 2001); Peter Barker and Bernard R. Goldstein, "Theological Foundations of Kepler's Astronomy," *Osiris* 16 (2001), pp. 88–113; Margaret G. Cook, "Divine Artifice and Natural Mechanism: Robert Boyle's Mechanical Philosophy of Nature," *Osiris* 16 (2001), pp. 133–50; and Margaret J. Osler, "Whose Ends? Teleology in Early Modern Natural Philosophy," *Osiris* 16 (2001), pp. 151–68; and Stephen D. Snobelen, "'God of gods and Lord of lords': The Theology of Isaac Newton's General Scholium to the *Principia*," *Osiris* 16 (2001), pp. 151–208.

[46] "Medieval philosophy, attempting to solve the ultimate *why* of events instead of their immediate *how*, and thus stressing the principle of final causality (for the answer to such a question could only be given in terms of purpose or use), had its appropriate conception of God. Here was the teleological hierarchy of the Aristotelian forms, all heading up in God or Pure Form, with man intermediate in reality and importance between him and the material world. The final *why* of events in the latter could be explained mainly in terms of their use to man; the final *why* of human activities in terms of the ultimate quest for union with God. Now, with the superstructure from man up banished from the primary realm, which for Galileo is identified with material atoms in their mathematical relations, the *how* of events being the sole objects of exact study, there had appeared no place for final causality whatsoever. The real world is simply a succession of atomic motions in mathematical continuity. Under these circumstances causality could only be intelligibly lodged in the motions of the atoms themselves, everything that happens being regarded as the effect solely of mathematical changes in these material elements." Burtt, *Metaphysical Foundations of Modern Science*, pp. 98–9.

[47] See Margaret J. Osler, "Whose Ends?"

endeavours? There is no denying the significance of his work in physics and mathematics, and equally there is no denying his preoccupation with theology and alchemy. Rejecting out of hand the undocumented and anachronistic suggestions that the latter concerns were products of either lead poisoning or senility, we can consider two reasonable suggestions. The one, defended most fully by Betty Jo Dobbs, is that Newton considered all of these pursuits as part of the same enterprise, the uncovering of divine activity in both the human and the natural worlds. According to Dobbs, Newton's system was:

> *not* just of 'the mathematical principles of natural philosophy.' On the contrary, it was to have been a grand unification of natural and divine principles, and it included a vision of God's activity not only *in* this world as we know it but also at the world's beginning and at its apocalyptic end and renovation. It was a vision in which the Arian Christ, as God's 'Agent' throughout time, always putting the will of the Supreme God into effect, kept God intimately connected both with the physical world and with humanity: that was Newton's ultimate answer to the twin spectres of deism and atheism that had always haunted him. It is also a vision that forces one to the conviction that one must give a religious interpretation not only to Newton's alchemy but to *all* of Newton's work, including the *Principia* and *Opticks*, since Newton himself was apparently motivated to study 'the frame of nature' in order to learn of God's activity.[48]

Dobbs' view that all of Newton's intellectual activities should be seen as a single enterprise rests on an assumption that for Newton—if not for most serious thinkers—there is a unity underlying diverse interests and modes of thinking.

Another possibility could be that, as a man of his time, Newton turned to the traditions available to him to deal with different sorts of questions. If he wanted to understand physics and cosmology, he turned to the mathematical traditions that grew from the work of Kepler and Galileo; if he wanted to understand the properties of matter, he turned to alchemy; if he wanted to support his Arianism, he turned to the history of the Church; if he wanted to interpret the book of Revelation, he turned to the methods of the seventeenth-century exegete, Joseph Mede. It does not follow that these enterprises were unrelated to each other, but viewing his activity this way helps situate him in the intellectual context of his time. This approach allows historians who find Dobbs' thesis about the unity of Newton's thought too strong to acknowledge that the various parts were important to him without imposing modern scientific standards on their interpretation of his work.

The changing image of Newton in recent scholarship parallels changes in the historiography of the Scientific Revolution. Indeed, the changing image of Newton has been one important element in producing those changes. As we

[48] Dobbs, *Janus Faces*, p. 254.

have learned to take seriously Newton's various intellectual preoccupations, we have come to learn that his own conception of his project is at odds with that of the late twentieth-century commentators who saw him in light of their own interests rather than his own. Because the traditional historiography of the Scientific Revolution was a forward-looking story which viewed Newton as the immediate *telos*, our changing understanding of his project inevitably casts a long shadow (or perhaps new light) on the individuals and subjects that have been at the center of the received view. The new Newton calls us to re-examine our narrative and our assumptions about intellectual life in early modern Europe.

ESSAY 2

Plans for Publishing Newton's Religious and Alchemical Manuscripts, 1982–1998

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Up to the beginning of 1982, I was only slightly interested in Isaac Newton's views on philosophy or religion. I had included him in a paper I wrote in late 1981 in the *Third Force in Seventeenth Century Philosophy*. I gave the paper in Israel in the beginning of 1982 at a conference organized by the Van Leer Foundation. It was mentioned to me that there were a large number of Newton manuscripts in the National Library in Israel. I think I had heard this once before from my colleague there, Joseph Agassi. I went to take a look and was amazed to see the enormous amount of Newton material that was in the manuscript collection of A. S. Yahuda. I was told that none of the material had been published. This led me to confer with the director of the Van Leer foundation, Yehuda Elkana, now president of the Central European University in Prague, about whether we ought to do something to get the Newton manuscripts published. He was enthusiastic and said he would cooperate financially and otherwise. He took me to meet with other important figures in Israeli cultural matters, who were enthusiastic but felt that more financial support was needed than they could give. I gradually learned that there was a large amount of Newtonian material besides what was in Jerusalem, still unpublished, encompassing Newton's theological and alchemical interests.

I soon learned the story that the material that Newton had passed on to his niece and she passed on to her descendants, ending with the Earl of Portsmouth in the twentieth century, had been auctioned off at Sotheby's in 1936. The earl had tried to give the material to the British Museum and Newton's college at Cambridge, and they both refused to take it. The bulk of the auction material was purchased by John Maynard Keynes and Professor A. S. Yahuda. Keynes took mainly the alchemic manuscripts and Yahuda, the

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theological ones. Others were purchased by people and institutions all over the planet.

With this much awareness of the extent of the Newton manuscript material, I decided, on returning to the United States in early 1982, to see if my former colleague, Richard S. Westfall, the leading Newton scholar of the time, would be interested in undertaking a role in the project. He told me that he had avoided coming to grips with what to do with the manuscript material but now that I had raised it and indicated there was support for an edition coming from Israel, that it might be worth seeing what we could do to obtain support in the United States. He told me that we should form a committee of the two of us and Betty Jo Dobbs and consult with others about what to do. We met in Chicago in the spring and decided to make an application to the National Endowment for the Humanities. This required a lot of preparation; part of it consisted of visiting the appropriate people in Washington. I went to visit somebody at the National Endowment and a couple of people at the National Science Foundation. I recall visiting a woman there who was in charge of applications in the history of science. When I told her we were interested in support for publishing Newton's theological and alchemical works, she looked through some literature she had and told me that alchemy was a science but not theology.

We decided to aim at getting the proposal in by 1984 and to try and start the actual work in 1985. The NEH seemed very supportive and kept advising us about the way to structure the proposal.

From 1982 to 1985, I spent a few months each year in Israel and became acquainted with the collection there and its history. It was part of an immense manuscript collection of Professor A. S. Yahuda, who was an Arabist who had taught in Spain, Germany and England. Most of the collection is of Middle-Eastern materials, but also contains the Newton theological writings, 11,000 items of Napoleana, the marked-up galley proofs of one of Einstein's early articles (which has been used to correct the printed text, which has some mistakes), and other treasures. Over ninety percent of the items in the Yahuda collection are in Middle Eastern languages. They contain exquisite examples of calligraphy, some of which are on display at the Islamic Museum in Jerusalem.

I learned from the librarians at the National Library that Yahuda was one of the most hated people in Israel. He had been the first Zionist from Palestine. An extremely wealthy man, he was involved in the early history of Zionism, but later became estranged because of the nationalist fervor of European Zionists. He broke with the Zionist organization at the time of the Versailles Treaty and became an opponent of their efforts to create a Jewish state. Yahuda spent most of his time till World War II in Western Europe. He had spent World War I in Spain because he couldn't leave during the hostilities. During that time he and another person in a similar situation, Max Nordau, set up the first synagogue in

Spain since 1492, in Madrid. Though they were both secularists, they enjoyed reviving Judaism in Spain. From his Spanish years Yahuda became known and was appointed Royal Professor, professor of medieval rabbinics, the first time the subject had been taught since the Expulsion. He used his professorship to search for physical records of Jewish life in Spain prior to 1492.

He left Spain in the middle 1920s because of the anti-Semitism he found in academic circles there and moved to Heidelberg. There he delivered a lecture on the accuracy of the Bible, in which he argued that the description of the Exodus had to written by an eyewitness since there were still Egyptian terms in the biblical account. Hence, it had to be written, Yahuda argued, by someone whose native language was Egyptian. His claim was disputed by Egyptologists but a physicist in the audience, Albert Einstein, said he wept when he realized that one could prove scientifically that the Bible was accurate. Yahuda was elated, of course, when he discovered that Newton used the same argument to prove that the Book of Revelation was written by an eyewitness to the destruction of the Temple because Aramaic terms appeared in the description. Yahuda was actually writing a comparative piece on his discovery and Newton's, which is in the his collection, when Hitler came to power. He moved to England and in 1940 came to America with all his manuscripts.

Yahuda claimed that he was the actual founder of the Hebrew University in the 1920s but that his efforts were canceled and erased as a European-style university replaced his plans for a Middle Eastern university. Yahuda carried on a long campaign against the growing Hebrew University and tried to set up an international investigation of it, headed by Albert Einstein, in the 1930s. As a result, the people who were professors there at the time had a very negative view about Yahuda and anything he ever did. In an attempt to find out more about him for a preface to an edition of Newton's manuscripts, I finally tracked down a friend of Yahuda's, a very elderly right-wing journalist. I was given a larger-than-life picture of Yahuda, an ardent secularist and proponent of the Middle Eastern way of life, who found himself at odds with the Eastern European Zionists and the Middle European intellectuals. Apparently, his views were politically on the right.

In America, he lived in New Haven and taught Arabic at the New School for Social Research in New York. He was a very close friend of Albert Einstein and had arranged for Einstein to leave Germany. Yahuda met Einstein at the Belgian border and then escorted him to London where he stayed with Yahuda's friend, the Spanish ambassador. A Chair had been arranged for Einstein at Madrid, which he never took. Other Chairs were arranged in Paris and Oxford, but Einstein decided to go to America and placed other German-Jewish physicists in the unoccupied Chairs. When Einstein was established in America, he arranged for Yahuda and his wife to come in 1940. They then tried to place Yahuda's collection of Newton papers with Harvard, Yale, or

Princeton. In spite of Einstein's strong letters of recommendation, all three institutions refused to take the material, so it remained with Yahuda until his dying moments. Einstein had pointed out in his letters that the Newton manuscripts contained the only extant explanation of how Newton went about dealing with intellectual problems. The manuscripts contain early drafts, notes, alterations, and the finished product. However, given that the finished product was not a scientific one but alchemical and theological, the premier American institutions refused to house the papers.

In America Yahuda did not seem to play much of a role in Jewish affairs. I was told that he refused to be an Israeli citizen in 1948. The one episode that suggests a possible role in Jewish affairs is when the messenger, Peter Bergson, in 1942 came to America to tell Roosevelt about the extermination policy of the Nazis. He could not get an audience with the government and was shunned by the Jewish establishment. He held a meeting in Yahuda's house in New Haven with interested parties. I asked him if Yahuda was involved in his project. He said no but he offered his house when he heard of the opposition of the Jewish establishment.

In his last hours, Yahuda was still debating what to do with the Newton papers and the rest of his huge manuscript collection. One of his students, Raymond Klibansky of McGill University, convinced him to will them to the National Library of Israel, even though Yahuda, by then, was one of the strongest opponents of the new state. His widow tried to stop the will and when she failed, committed suicide. Yahuda's heirs contested the will and a court process ensued that lasted from 1952–1968. People were called as witnesses about whether the manuscripts would be properly taken care of in Israel and whether there were scholars there who could profit from them. The court ordered the will to be enforced in 1969, and in 1972, much to the surprise of the National Library of Israel, crates and crates of material from Yahuda arrived in Jerusalem, along with a huge portrait of the donor. The chief librarian of the time told me that they had no idea what the Newton stuff was about or why they were receiving it. Fortunately, a Newton scholar, David Castilejo, was there and realized what had arrived. He prepared the typewritten inventory which has made it possible for the rest of us to use the collection.

Sam Westfall saw a notice about the papers having arrived in Jerusalem in 1972 and requested a microfilm copy. It is this microfilm that was used by Westfall in his biography of Newton and by the rest of us in copies of copies of copies. I learned from the librarian that the equipment they had in 1972 was rather primitive and that they did not photograph pages that were too big or too small, or too dark or too light, so that the extant microfilm was imperfect. So it appeared to me that we would have to recopy everything. Also, as I worked through the papers I would find notes reporting that the next page was in Lord Keynes's collection, that somehow some of Yahuda's papers and Keynes's got

mixed up. In Yahuda's correspondence there are some charming letters about how he and Keynes would meet for tea in Bloomsbury and exchange pages.

Besides getting some idea of what was in all the Newton material, I kept looking for more items in various libraries and found several pages at the University of Kentucky and elsewhere. I suppose my best find was when somebody told me at a Fourth of July picnic in Santa Monica, that a friend of his had a Newton manuscript on her wall in New York. It took many months of intricate negotiations to get the owner to invite me over, and there, in the Bronx, was a letter Newton had received at the Mint and which he had written in all the margins about how he knew that the Book of Revelation was genuine and accurate. The owner was unwilling to let me photograph it but let me make a copy by pen. I learned from her and from the book dealer who had sold the material that is in the University of Kentucky, that Newton manuscripts kept coming on the market. The leading rare book dealer in Los Angeles, Jacob Zeitlin, told me he had dealt with several rare items. I also learned that the Seventh Day Adventists had a manuscript of Newton's on twenty questions concerning the Second Coming of Christ. They willingly gave me a copy and said they had no idea where the manuscript came from. Tracking back from manuscript sales, I found they had bought it in 1942 for $200 and that the Library of Congress had previously owned it. When I wrote the Library of Congress, inquiring why they sold it, I got a very stern letter saying they never sell manuscripts. I also learned that the French antique dealer named Fabius had some alchemy papers of Newton. I asked my friend, Paul Dibon, to make inquiries. He reported that he went to M. Fabius's establishment and found the man in his pajamas. When the matter of Newton was raised, M. Fabius became hostile and paranoid, so we were unable to find out what exactly he had. A few years later a cousin of his became Prime Minister of France. I asked a friend of the Prime Minister if there was any way of getting information. By then the antique dealer was no longer among the living, so we never were able to find what he had and what had become of it.

All of this made us realize we had to get a complete inventory of what became of all the manuscripts from the Sotheby auction. Peter Spargo had been doing this and we hoped to enlist his aid. It also seemed that more searching had to be done for casual acquisitions that had occurred in the United States and elsewhere long after the auction. We would also need to find a crew of people who would transcribe the manuscripts and a crew of people who would be able to provide the scholarly apparatus. We gradually worked on our proposal to the NEH and submitted it in 1984. In the spring of 1985 the Van Leer Foundation invited Westfall and Dobbs to join me at a colloquium in Jerusalem. It was the first time either of them had seen the actual manuscripts and they were quite excited. At this colloquium I gave a paper on Newton and fundamentalism which probably dismayed Sam very much, since he was convinced that Newton had ended up a good, rational deist. We happily planned for the beginning of

the project. We had also contacted Cambridge University Press, which had put out Newton's mathematical papers and Newton's letters in elegant editions. The Cambridge University Press editor in New York, whom I visited, told me they would be delighted to contract for sixteen volumes on the theological and alchemical papers. A contract was actually drafted and vetted by Sam, Betty, and myself and was sent off to England to be prepared in final form by Cambridge.

With all this, our attempt to launch the Newton project came to a screeching halt when the NEH failed to fund our project and Cambridge lost the contract. The NEH, which has been so positive week after week, informed us there was a mistake in Betty's transcription and translation of a Latin page and that the funds requested were outrageous. When I went over the details over the phone and showed the woman at the other end that the financial complaint was completely bogus, it was just a misunderstanding at their end, she told me firmly that did not matter, they were definitely turning us down and we should not bother reapplying.

We were convinced that the people who had not wanted anything to do with Newton's religious and alchemical opinions and wanted to preserve his position as a pure scientist, were behind this. Westfall and Dobbs had had many run-ins with the scientific establishment in England and America. I went to Washington to try and find out what happened and to reinstitute applications for funding. I went to see the director of historical work at the National Science Foundation. He calmly indicated that he had told the NEH not to fund the project. As I tried to draw him out as to why he was so adamant, and why he did not want this material of Newton's to be available to scholars, he told me he would be willing to fund making a microfilm of all of Newton's manuscripts and placing the microfilm at the University of Northern Alaska, where any scholar could look at them, if he or she wished.

We reconsidered our options. Sam was leery of approaching any religious foundation. I made tentative inquiries with the Rockefeller Foundation and others. In 1986 I moved to Los Angeles. There I met a woman who was coordinator for some of the large cultural foundations. She was very interested and prepared a request to the Armand Hammer Foundation and some others out here. She seemed so sanguine that I began to look for a place to locate the Newton project in the Los Angeles area. The University of California, Los Angeles did not seem to have the space, so I talked to the Provost at University of Southern California, who was delighted with the idea. Betty Jo, James Force and I went to see the Getty, which showed little interest. The person we dealt with kept insisting they were only interested in artistic things. In the next few years, Sam dropped out because of his failing health and Betty Jo became reluctant to put much more time and energy into it. I kept sounding out various people and institutions about it. The director of Kluwer Academic Press got very interested and wanted to publish all sixteen volumes in similar

format to the Cambridge edition. He made out a contract, which I still have. He also gave me a small research fund, which was used to get David Katz to find out how the people at the University of Sheffield had managed to put the Hartlib Collection on computer disks. In 1992 he and I went to Sheffield and he was shown the inner secrets of the Hartlib project. We thought at this time that we could at least start producing computerized copy of one manuscript at a time, with transcriptions and notes. James Force took on the job of putting one Newton manuscript, namely the one at the Clark Library, online with much more advanced equipment than had been used at Sheffield and I think Jim's achievement is the first indication of what could really be done.

Soon I had lost my original committee members when Sam, and later, Betty, died. I drafted Jim Force and David Katz and Simon Shaffer to be a reconstituted committee. I kept looking for possible sponsors and sources of funds here and abroad. In the mid 1990s, I began to look for computer millionaires or billionaires who might be interested. A local physicist who had invented some important process was wooed unsuccessfully. Various people who were making their fortunes in computers listened to me sympathetically but showed no eagerness to put up the money. I was still pursuing this line of attack up until a couple of years ago and got as far as meeting somebody who knew an advisor to the Bill and Melinda Gates' Foundation and who would endorse the project. I was ready to go on from there to discussing it with the one and only billionaire I know, who gives lots of money to academic charities. Then, much to my surprise, I learned that an approach in England was being made to the British Arts and Humanities Research Board and that several of my friends were involved. In view of the history of my efforts, I did not hold out too much hope and was very, very pleasantly surprised when the AHRB put up the money to start the project. It will probably still be necessary to tap other sources, such as those I was pursuing. However, there is now light at the end of the tunnel.

One explanation of why the tide has turned is that over the past eighteen years the study of Newton's theological and alchemical writings has become somewhat respectable. The first to write about it, including Frank Manuel and Sam Westfall, were pretty dubious about the merits of Newton's religious thoughts. The studies by them and others of the time did not try to see Newton's achievements in terms of what was going on in theological writings at the time and where Newton fitted into that area. The studies of Betty Jo Dobbs on Newton's alchemy showed that he had most interesting views in the context of what alchemists of the mid-seventeenth century were discussing. In 1985 I showed that Newton's theological views were used by early fundamentalists and continued to have influence into the twentieth century. Also, two papers I published on Newton and Maimonides put Newton in the current of major theological writers who were being discussed in the seventeenth century. This showed that Newton was not just idiosyncratic but that he was part of a

larger world of intellectuals trying to relate nature and Scripture. The work of Betty Jo Dobbs, Jim Force, Rob Iliffe, Justin Champion, Scott Mandelbrote, Peter Harrison, Sarah Hutton, Maggie Osler, Margaret Jacob, Steve Snobelen, Lawrence Principe and Larry Stewart, has shown that Newton's so-called irrational side makes sense when seen in context and provides much greater understanding of what Newton himself was trying to accomplish in all of his intellectual work. We may soon be able to substantiate a hypothesis I offered in 1987 that perhaps Newton was a great seventeenth-century alchemist and theologian, who dabbled a little bit in the physical sciences, and that his main concerns deserve our serious attention if we are to understand the full Newtonian Revolution.

ESSAY 3

Digitizing Isaac: The Newton Project and an Electronic Edition of Newton's Papers

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The nature of Newton's private beliefs has been a source of fascination ever since he died in the spring of 1726/7. In his lifetime, rumours persisted that his religious faith, although deep, was heterodox, and his supporters were frequently obliged to defend his orthodoxy. After his death, evidence of his deep immersion in chronology and prophecy became available in the form of publications of some treatises, authorised by his descendants as they tried to make money from his legacy. In the early 1750s his analysis of what he took to be precarious pro-trinitarian passages in Scripture (originally expressed in two letters to John Locke) appeared in an Amsterdam publication. As a result, his relatives once more tested the market for publications of his writings by sending a selected batch of theological papers, by now in the possession of the Earl of Portsmouth, to the pro-Newtonian divine Arthur Ashley Sykes. These were soon passed on to the Reverend Jeffrey Ekins, though he thought little of them and they remained with the Ekins family for over a century. Until the twentieth century Newton's alchemical interests attracted little serious scholarly attention, being thought of as something of an embarrassment, while there seems to have been little or no effort to investigate his administrative papers.[1]

[1] See Isaac Newton, *Chronology of Ancient Kingdoms Amended* (London, 1728); Newton, *Observations upon the Prophecies of Daniel, and the Apocalypse of St. John. In Two Parts* (London, 1733); and Newton, *Two Letters of Sir Isaac Newton to Mr Le Clerc, late Divinity Professor of the Remonstrants in Holland. The Former containing a Dissertation upon the Reading of the Greek Text, 1 John v. 7; the Latter upon that of 1 Timothy iii, 16. Published from authentic MSS. in the Library of the Remonstrants in Holland* (London, 1754.) For responses to the General Scholium to the second edition of the *Principia Mathematica* of 1713, see Larry Stewart, "'Seeing Through the Scholium', Religion and Reading Newton in the Eighteenth

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 23–38.
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The 'scientific' portion of Newton's archive was disaggregated from the other papers in 1888 and was donated to Cambridge University Library by the fifth Earl of Portsmouth. Virtually all the rest was sold off in lots at the Sotheby Sale of 1936. The idea of producing a complete edition of Newton's writings was mooted periodically in the nineteenth and early twentieth centuries but understandably, most attention was paid to his scientific papers. A call to produce a modern edition of Newton's scientific and mathematical writings was made in 1924 by the President of the Royal Astronomical Society (and eminent historian of science), J. L. E. Dreyer, who requested that the nation honour Newton's achievements in this manner on the bicentenary of his death in 1927. He argued that it would not be worthwhile to print the theological and chronological papers and condemned Newton's three decades' of wasted employment at the Mint as "utterly deplorable." Following this, the astronomer R. A. Sampson recalled an earlier proposal in which the Cambridge Philosophical Society had planned to publish an edition of the scientific works in 6 quarto volumes of about 600 pages each. Sampson had little to say about the theological or Mint papers, but he suggested that, given the amount of time Newton had spent on the topic, his alchemical work should be taken seriously. However, he warned that any future editor of Newton's papers would have to immerse himself in Newton's "defunct" world for many years and "probably he would never quite find his way out of it."[2]

The first sustained effort to produce an edition of any part of Newton's papers since Samuel Horsley's publication of Newton's works (between 1779 and 1785) involved his correspondence. A committee to collect transcripts of letters to and from Newton was set up at the Royal Society in 1938; after a setback in its progress due to the ravages of wartime, E. N. daC. Andrade headed another committee with an identical mission in 1947. Publication of Newton's works appeared in a torrent from the late 1950s. Under the editorship of H. W. Turnbull, volume one of the seven-volume edition of the correspondence appeared in 1959 while single monograph editions of portions of Newton's scientific writings appeared under the editorship of John Herivel and Rupert and Marie Boas Hall in the early 1960s. Tom Whiteside's monumental eight-volume edition of Newton's mathematical writings appeared at regular

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Century," *History of Science* 34 (1996), pp. 123–65; more generally see Rob. Iliffe, " 'A connected system': The snare of a beautiful hand and the unity of Newton's archive," in M. Hunter ed., *Archives of the Scientific Revolution* (Woodbridge, Suffolk: Boydell Press, 1998), pp. 137–57. I would like to thank Dolores Iorizzo and John Young for comments on previous versions of this paper.

[2] Dreyer's remarks are published in his "Presidential Address" in the *Monthly Notices of the Royal Astronomical Society* lxxxiv, no. 4 (Feb. 1924), pp. 298–303; see, p. 300. Sampson's remarks are also published in the *Monthly Notices of the Royal Astronomical* Society in the March 24, 1924, issue, pp. 378–83; see pp. 381–2.

intervals between 1967 and 1981 and the first of Alan Shapiro's three-volume edition of Newton's optical writings appeared in 1984.[3]

Before the heroic initiatives discussed in this book by Dick Popkin (see Essay 2), there was little or no call for an edition of Newton's alchemical or theological papers although a somewhat woebegone publication of some theological papers housed at King's College, Cambridge appeared in 1950. Nevertheless, even as the publication of Newton's scientific work took off, historians of science were becoming concerned with broader and, for some, less palatable aspects of intellectual activity in the early modern period. Sailing on the general historiographical *zeitgeist*, the work of Ted McGuire, Piyo Rattansi, David Kubrin, Margaret Jacob, Karin Figala, David Castillejo, Simon Schaffer, Betty Dobbs, Sam Westfall, Frank Manuel, Jim Force, and Dick Popkin showed that Newton was deeply immersed in chronology, alchemy and theology, and demonstrated that he had been deeply committed to the notion of a Newtonian *prisca sapientia*. Much of this historical work showed that whatever Newton's prowess in optics, mechanics, physics and mathematics, his interest in the non-scientific subjects and traditions was common in the period. There was now a clear schism in Newton scholarship between those who concentrated on the scientific and mathematical papers (and the internal development of Newton's conceptual researches) and those who were concerned with either the "contexts" of his life and work and/or his "irrational" interests. At its worst, historians of Newton's work in the exact sciences actively obstructed efforts to attract funding for a scholarly edition of the alchemical and theological writings. Without any claim to a comprehensive edition or coverage of Newton's broad range of interests, the piecemeal publication of his writings contrasted unfavourably with the support given at a national level (and often for nationalist purposes) for editions of the complete works of other scientific heroes such as Leibniz, Copernicus, Galileo, Kepler, and Huygens.[4]

[3] The more substantial editorial projects have been: H. W. Turnbull, J. F. Scott, A. R. Hall, and L. Tilling, eds., *The Correspondence of Isaac Newton*, 7 vols (Cambridge: Published for the Royal Society at the University Press, 1959–77); D. T. Whiteside, ed., *The Mathematical Papers of Isaac Newton*, 8 vols (Cambridge: Cambridge University Press, 1967–81); A. R. Hall and M. B. Hall, eds, *Unpublished Scientific Papers of Isaac Newton*, (Cambridge: Cambridge University Press, 1962); J. Herivel, *The Background to Newton's 'Principia'. A Study of Newton's Dynamical Researches in the Years 1664–84* (Cambridge: Cambridge University Press, 1964); A. E. Shapiro, ed., *The Optical Papers of Isaac Newton*, 3 vols continuing, (Cambridge: Cambridge University Press, 1984–); and J. E. McGuire and M. Tamny, eds, *'Certain Philosophical Questions': Newton's Trinity Notebook* (Cambridge: Cambridge University Press, 1984.)

[4] See H. J. MacLachlan, ed., *Sir Isaac Newton Theological Manuscripts*, (Liverpool: Liverpool University Press, 1950); J. E. McGuire and P. M. Rattansi, "Newton and the 'Pipes of Pan'," *Notes and Records of the Royal Society of London* 21 (1966), pp. 108–43; D. C. Kubrin, "Newton and the Cyclical Cosmos, Providence and the Mechanical Philosophy," *Journal of the History of Ideas* 28 (1967), pp. 325–46; F. E. Manuel, *A Portrait of Isaac Newton* (Cambridge, Mass.: Harvard University Press, 1968); Manuel, *The Religion of Isaac Newton* (Oxford: Oxford University Press, 1974); B. J. T. Dobbs, *The Foundations of*

Research on Newton's non-scientific writings grew exponentially from the late 1980s, just as scholarly endeavour on his natural philosophy, mathematics, and mechanics fell off. This process reinforced the historically fractured view of Newton's intellectual interests although an opportunity to prevent this situation from becoming worse presented itself when Chadwyck-Healey released a microfilm collection of Newton's writings in 1991. For the first time since the early 1870s, and arguably since Newton's death, a comprehensive portion of his intellectual legacy was available for analysis in one "site." By now, many of the original papers were strewn to the corners of the globe although nearly all the scientific papers were in the Portsmouth collection at Cambridge University Library. Some early correspondence and mathematical tracts collected by John Collins in the late seventeenth century were in the possession of the Earl of Macclesfield until 2001 but have now permanently joined the Portsmouth papers at Cambridge. The alchemical papers were mainly located at King's College, Cambridge in the Keynes collection, which also contained some significant theological material from the early eighteenth century. A broad range of theological papers was also based at New College, Oxford, where the texts retained by the Ekins family had been deposited in 1872. However, the most exciting trove of these writings had been located in Jerusalem since the 1960s. Despite being available in microfilm from the early 1970s, the Yahuda collection (containing Newton's earliest theological writings) was little known and had not yet been studied in depth. Other significant deposits were owned by the Fondation Martin Bodmer and the Dibner Institute, Cambridge, Mass.. The time was ripe to make these extraordinary writings more widely available in an edited, scholarly form.[5]

The Newton Project

The heightened scholarly interest in the non-scientific papers gave rise to a meeting at Imperial College London in 1998. Here the Newton Project was formally constituted, consisting of a loose collaboration between scholars from

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Newton's Alchemy, or, 'The Hunting of the Greene Lyon' (Cambridge, Cambridge University Press, 1975); K. Figala, "Newton as Alchemist," *History of Science* 15 (1977), pp. 102–37; R. S. Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge: Cambridge University Press, 1980); D. Castillejo, *The Expanding Force in Newton's Cosmos as Shown in Unpublished Papers* (Madrid: Ediciones de Arte y Bibliofilia, 1981) and B. J. T. Dobbs, *The Janus Faces of Genius* (Cambridge: Cambridge University Press, 1992).

[5] See, amongst others, J. E. Force and R. Popkin, eds., *Essays on the Context, Nature, and Influence of Isaac Newton's Theology* (Dordrecht: Kluwer, 1990); Scott Mandelbrote, " 'A Duty of the Greatest Moment': Isaac Newton and the Writing of Biblical Criticism," *British Journal for the History of Science* 26 (1993), pp. 281–302; and Rob Iliffe, " 'Making a shew': Apocalyptic Hermeneutics and Christian Idolatry in the Work of Isaac Newton and Henry More," in J. E. Force and R. H. Popkin, eds, *The Books of Nature and Scripture: Recent Essays on Natural Philosophy, Theology, and Biblical Criticism in the Netherlands of Spinoza's Time and the British Isles of Newton's Time* (Dordrecht: Kluwer, 1994), pp. 55–98.

institutions based in Cambridge (UK), London, and the United States. The Newton Project was formally composed of a senior editorial board and a group of four advisory editors, with about twenty advisors who were to comment on various aspects of the project. The sentiment underlying the meeting was that Newton's non-scientific (theological, alchemical, and Mint) papers were of international cultural significance and it was proposed that they should appear in a print edition of about 20 volumes, conforming to the best modern scholarly standards. As a result of this decision, the Newton Project applied at the end of 1998 to the U. K. Arts and Humanities Research Board (AHRB) for £330,000. These funds were intended to support a five-year project based at Imperial College London that aimed initially at transcribing and editing the theological papers. In the summer of 1999, confirmation arrived that this bid had been successful and the Newton Manuscript Project appointed Dolores Iorizzo and John Young as the two transcriber/editors, with Rob Iliffe as project director. The AHRB project began in January 2000.[6]

The AHRB application form had contained a small section requesting information about the possible publication of the print edition in an electronic form, and discussion took place as to what the nature of such an undertaking would be. Having been aware of problems associated with previous scholarly publications on CD-ROM, we made a commitment to make the research accessible on the Web in a basic HTML (HyperText Markup Language) form which could be deposited (with copyright) with the Arts and Humanities Data Service (AHDS). However, once we began to design a Newton Project website, it became clear that our general conception of how the project might be published online had taken no account of the extraordinary changes that were taking place in the field of online editorial projects. In fact, the general revolution then taking place in the provision of electronic facilities in many different sorts of media (the AHRB work began just as the dot.com boom reached its peak) would necessarily impinge on all the goals and procedures of the project.[7]

Members of the AHRB team soon became aware of a number of already existing web projects and many even more ambitious initiatives. It was now obvious that the simple Word-to-HTML model, and indeed the entire Print-to-CD or LAN (Local Area Network, available online to password holders) way of thinking—in which print was a logically prior medium determining the form and content of the e-publication—was grossly inadequate. Once a commitment was made to hosting the material on the Web in a sustainable format,

[6] The initial meeting at Imperial College was organised by Harvey Shoolman.

[7] Current best practice for electronic editions are recommended by organisations such as the Model Editions Partnership (MEP); see for example the MEP "Prospectus for Electronic Historical Editions" <http://adh.sc.edu/mepinfo/MEP-Docs/proptoc.htm> (accessed 19 Novemer 2001) and Susan Hockey and C. M. Sperberg-McQueen, "Markup Guidelines for Documentary Editions," (4 July 1999), <http://adh.sc.edu/MepGuide.html> (accessed 19 January 2001).

a number of different and novel possibilities for shaping the edition presented themselves. While the idea of a print edition was by no means shelved, the potential uses and scope of an online production seemed to dramatically outstrip what its print counterpart could offer. We decided that material should be posted on the Web in a searchable form as soon as it was created, and all the relevant texts—not merely editorial selections—should be provided alongside high quality simulacra of the originals.

Over time, the Newton Project has devised a rigorous system for transcribing, "tagging" (or marking up) and checking work done. Original transcriptions are made from good photocopies printed from microfilm although, as Popkin points out in his paper (Essay 2), many photographers have been unable to capture images of extremely large folios or of very small scraps of paper, and these did not appear on the microfilm. At the first stage, documents are simultaneously transcribed and tagged in XML (or Extensible Markup Language), while later the transcription is checked by an independent scholar and, finally, the upgraded document is checked against the original. HTML informs a browser how a document looks on a screen, indicating that a particular text constitutes a paragraph, a table, or a line of verse. XML, a shorter version of the more general SGML (Standard Generalised Markup Language, an international standard since 1986) is a "syntax framework" that specifies how tags should be defined. In principle, any relevant part of a particular text, or "element," can be tagged, e.g., a personal name, a physical concept or a geographical place. At the start of an XML document, a Document Type Definition (DTD) has to be invoked that specifies the names of elements within that text as well as the relationships that can exist between them. As long as the use of these definitions and tags is consistent within a text, powerful searches can be made of groups of texts that have been encoded with the same DTD. Provided other projects use a DTD that uses the same core tags, then different projects can be harmonised.[8]

In order to create a consistent set of tags across humanities computing projects and beyond, the Text Encoding Initiative (TEI) had been formed in 1987. The Newton Project encodes according to core tags developed by the TEI that have been customised by John Young in the Newton Project DTD. Although some large projects use a division of labour in which tagging of already transcribed texts is outsourced, the markup of Newton documents can only be performed by scholars who understand both the contexts of and the elements within the text. This approach has entailed that members of the

[8] The existence of a multiplicity of stages of tagged and checked texts, each always potentially being revisable, requires an immense level of organisation. All this is complicated further by the need to 'proliferate' files to members of the project and indeed to back-up the website on multiple servers for safety and long-term preservation. Problems of file-level versionitis are relieved by the existence of tags that note and track the latest stages of each document.

project have become competent in a number of different areas of the text encoding process, a situation that has proved useful in cross-checking both the tagging and the transcriptions made by others. The creation of documents and texts produced in this way is more labour-intensive than was initially envisaged, and proficiency in these areas has required a great deal of training and learning-by-doing. However, one gains greatly from the fact that XML permits and, indeed, enforces a much higher degree of precision in capturing elements of the text than is possible in a cruder format. The extensibility of the format is also supposed to "future proof" texts written according to it in the sense of making them compatible with later developments in accompanying software. Additionally, the Newton Project uses a stylesheet created according to the XSL (Extensible Stylesheet Language) that programs a browser to display an XML transcript in a certain form. Currently, the stylesheet allows the user to switch dynamically between a fuller "diplomatic" text, which displays all additions and deletions, and a "cleaned up," or "normalised text', although we intend to make an even greater choice of displays available in the future. As I point out below, the power of the online edition as a research resource has recently been massively increased by the availability of high quality facsimile images that are connected to simultaneously viewable transcriptions.[9]

In 2000, Rob Iliffe completed a provisional catalogue of the non-scientific papers by adding detailed theological notes to the description of the Portsmouth papers made in 1888, the catalogue of the Sotheby sale papers drawn up by John Taylor in 1936, and the list of Newton's Mint papers compiled by John Craig in the 1950s. It became a highly significant research resource in 2001 when John Young checked each entry in detail against what was on the microfilm and it was made available online. In addition to this, the online catalogue incorporated the research undertaken by Peter Spargo (based on the private papers of John Maynard Keynes and Abraham Yahuda) on the history of the individual lots sold at the Sotheby sale in 1936. At the end of 2003, all the private papers of Keynes relating to his broad interest in Newton were made available as part of the Newton Project website, and we intend to place online the relevant material from Abraham Yahuda's papers in 2004. The Newton Project was awarded a grant by the Royal Society in April 2002, to convert it into an XML version of the standard Encoded Archival

[9] In the U.S., the TEI is currently supported and sponsored by (inter alia) the Association for Computing in the Humanities (ACH), the Association for Literary and Linguistic Computing (ALLC), and the Association for Computational Linguistics (ACL). Amongst others, TEI is used by the American and French Research on the Treasury of the French Language (ARTFL) <http://humanities.uchicago.edu/orgs/ARTFL/>), the Woman Writers Project at Brown University; see e.g., Julia Flanders, Editorial Methodology and the Electronic Text," <http://www.wwp.brown.edu/encoding/research/NASSR/Argument.html> (accessed 20 June 2002).

Description (EAD) format. The catalogue is one of the primary foci of the site as a whole, serving as a gateway to individual texts as well as being a significant source of information in its own right.[10]

The Online Medium

In the past four years the Newton Project has spent an immense amount of time creating a sustainable website whose aims far outstrip what we envisaged at our first meeting. Nevertheless, despite the many advantages presented by the online medium, it is not intended to make redundant any print versions of the non-scientific material that we publish, or replace preceding print editions of the scientific papers. The two media are simply different. An online edition should not be seen as a surrogate of "books" or "pages," despite the retention of the physicalist concepts from the culture of print. Indeed, as I suggest below, electronically presented information is always intrinsically a research *tool* in a way that the material book is not. Both media have potential drawbacks. Aside from the inevitably contentious editorial selection that is usually involved in creating print editions, print can fail to represent the dynamic processes involved in writing and redrafting. Moreover, printed editions are cumbersome in representing the textual emendations that appear on heavily reworked manuscripts. On the other hand, the electronic edition cannot convey the physical qualities of a printed text, and its capacity to represent the various drafts of a particular piece can fail to capture the temporal specificity and cultural force of a printed book. In any case, scholars working at the cutting edge of online editing now envisage a situation in which some kind of printed, material product is used in tandem with an online resource/tool that contains a much larger amount of Newtonian and other related material, that permits fascinating new questions to be asked of these documents and that carries out these operations in a matter of seconds.[11]

The electronic edition is also well suited to the almost entirely private, secretive, and handwritten nature of Newton's continually redrafted writings. Newton was actively hostile to print and to the wide circulation of his manuscripts, whether in mathematics, natural philosophy, theology, or alchemy. In the form of images of his autograph, the medium of the Web is also an excellent forum for representing the look of Newton's work, whose real and projected audiences were tiny in number. The very lack of an existing print edition of

[10] The catalogue is presently housed at <http://www.newtonproject.ic.ac.uk/catalogue/ newton.htm> The EAD work was undertaken by the AUSTEHC group at the University of Melbourne.

[11] For a good introduction to many of the issues involved in online publishing, see S. Hockey, *Electronic Texts in the Humanities: Principles and Practice* (Oxford: Oxford University Press, 2000), esp. chaps. 3 and 8.

Newton's non-scientific papers has made it easier to come to terms with the way Newton himself organised his work. Fortunately, there is no allegedly definitive print edition of the non-scientific papers to cast a baneful influence over what we do, and the intense concentration on the original documents means there is no danger of doing a twenty-first century version of a previous print edition. As for his disdain for the world of print, other writers such as the American poet Emily Dickinson, felt that print mangled the complex stylistic idiosyncrasies of her work and she circulated her correspondence and manuscript books, with all their meaningful sketches and other embellishments, to a select audience. As a result, both contemporary and more recent representations of her work in mechanical type are singularly unsuited to the goals she was trying to achieve in writing. Modern editors of her work now proclaim the need to "unedit" her writings and to situate them in the contexts that Dickinson herself felt were appropriate. The online environment, with its capacity to represent the intimacy and techniques of her pictorialised texts is ideal for this activity and the Dickinson Electronic Archives Project is using this medium to offer fruitful new insights into her oeuvre.[12]

Concerns have been raised in some quarters that the reliance upon the easy facilities provided by the Web constitutes a serious threat to the sorts of activities and hard-won competencies that give academics whatever value they possess. Whether or not the more extreme expressions of these fears are justified, gigantic commercial and cultural forces unleashed in the last decade mean that Canutish resistance to the digitisation of large swathes of academic culture is futile. Virtually every commercial and educational group associated with the provision of e-based information (nearly all print is now initially inputted in some proprietary word-processing form) has an interest in creating a stable environment in which purchasers and end users can make use of the astonishing potential of the Internet. For example, publishers, supermarkets, defense-related companies, librarians, archivists, museum curators, and scholars are all concerned with developing and using software and hardware standards that allow "interoperability," i.e., the possibility of accessing and "talking to" information created in other settings. Implementing basic metadata (i.e. data about data) standards, such as "Dublin Core"

[12] See Martha Nell Smith, Ellen Louise Hart, and Marta Werner, "Detailed Description of the Archive", <http://jefferson.village.virginia.edu/dickinsonarchive_description.html> (accessed 11 March 2002) and Martha Nell Smith, "Because the Plunge from the Front Overturned Us: The Dickinson Electronic Archives Project" <http://jefferson.village.virginia.edu/dickinson/plunge1.html> (accessed on 26 March 2001; published in print in *Studies in the Literary Imagination* 32 (1999)); and Martha Nell Smith, "Corporealizations of Dickinson and Interpretive Machines," in G. Bornstein and T. Tinkle, eds., *The Iconic Page in Manuscript, Print and Digital Culture* (Ann Arbor: University of Michigan Press, 1998), pp. 195–221—available in print facsimile at <http://www.iath.virginia.edu/dickinson/resources/smith_corp/corp1.html> (accessed at 11 March 2002). There is of course an irony inherent in a situation where text intendended for a handful of select readers is exposed to the gaze of countless end users.

(Z39.50), and those developed by the Text Encoding Initiative (TEI), ensure that projects and schemes based on these standards will not become obsolete or examples of "legacy" technology. Bodies such as the World Wide Web Consortium (W3C) are also working with scholars and software developers to create a new version of the Internet that will dramatically enhance the facilities that are already available.[13]

Facilities such as hyperlinks have utterly transformed existing ideas of reading, researching, publishing, writing, and, indeed, the nature of text itself. Properly constructed online text permits and indeed demands a form of "nonlinear" reading; as a result, the standard form in which text is represented is in the form of a "page," in which embedded hyperlinks allow the reader to jump to any topic that takes his or her fancy. Well-designed projects contain internal search instruments and other functionalities that facilitate the search and retrieval of information from any part of the website. Most significantly perhaps, a website can 'hold' or provide access to many times the amount of information found in a relevantly corresponding printed environment, a figure that of course rises exponentially when links are made outwards from the site to other online locations.[14]

The online medium has also dramatically changed the relationship between the editor and the reader/ end-user and, indeed, the nature of editing itself. Although there have been many schools of editorial method, the classic print edition could be characterised as consisting of a set of volumes, produced according to thematic or chronological modes of organisation, in which the editor selected texts that were the most significant according to his or her view. In many cases, the assumption was made that the printed version of the text was the most perfected version of the work, and thus what the author most clearly 'intended' as an end result. Recently, editors have become keenly aware of the dangers of imposing their own selective and interpretive restrictions on contemporary and future readers, and have therefore aimed to present as many

[13] The Newton Project is a member of the TEI Consortium and is also committed to the aims of the Open Archives Initiative (OAI). This promotes the free exchange of non-proprietary software that will facilitate the creation of architecturally compatible (i.e., relevantly similar software and metadata) resources; see the OAI Metadata Harvesting Protocol at <http://www.openarchives.org> and Clifford Lynch, "Metadata Harvesting and the Open Archives Initiative," *A.R.L. Bimonthly Report* 217 (August 2001) <http://www.ar1.org/newsltr/217/mhp.html> (accessed 19 June 2002).

[14] Even if it is true that certain aspects of reading are necessarily linear, in the sense of requiring sequential prose that conveys the logical structure of an argument or narrative, the online medium facilitates the retrieval of information far better than does the printed book. For general thoughts about the hypertext medium, see George Landow, *Hypertext: The convergence of Contemporary Critical Theory and Technology* (Baltimore: Johns Hopkins University Press, 1992); Jerome McGann, "The Rationale of Hypertext" (1994) <http://jefferson.village.edu/public/jjm2f/rationale.html> (accessed 1 September 2000); P. Shillingsburg, *Scholarly Editing in the Computer Age: Theory and Practice*, 3rd ed. (Ann Arbor: University of Michigan Press, 1996); A. Renear, "Out of Praxis: Three (Meta) Theories of Textuality," in Kathryn Sutherland, ed., *Electronic Text: Investigations in Method and Theory* (Oxford: Clarendon Press, 1997), pp.107–26; D. C. Greetham, *Theories of Text* (Oxford: Oxford University Press, 1999).

texts and as much information as possible about the texts concerned. However, marketplace realities have intervened; the printed form has made texts with detailed annotations almost impossible to represent in their entirety and ambitions towards comprehensivity have been increasingly limited by space. These drawbacks, especially acute when there are many different versions, or heavy deletion or interlineation, are well documented.[15]

A standard edition, published according to the traditional academic structure, might constitute the lifetimes' work of one or many individuals with scholarly volumes only appearing after a substantial period of time—by which time the editorial approach is quite possibly passé. Given the monumental nature of some of these productions, it is simply unfeasible to reconfigure (or create new) editions every year or even every decade. With the exception of Shakespeare, most canonical authors only get their definitive editions every generation or two. This is not to say that print editions have restricted scholarly activity, but it should be noted that skilled users now expect much more from editions than they did fifty years ago. As already mentioned in relation to the works of Emily Dickinson, a great deal of recent textual scholarship has been involved in 'unediting' or going back beyond the effects of previous generations' definitive editions. Another serious issue is that it is precisely those apparently unimportant pieces of text that editors neglected to include in the definitive editions (for example, in the cases of Galileo and Huygens) that have proved to be of greatest interest to recent scholars. If the response to this criticism of print culture is that the committed scholar can always go and consult the originals, then in turn the reply must be that for conservation reasons these are increasingly inaccessible—librarians point out that you can consult the edition—while in any case, such a demand surely negates the point of a supposedly definitive scholarly resource. All this militates against a too easy assumption that one has published everything that Newton ever wrote, though obviously a Web edition can easily incorporate any new findings.

Recently, there have been justified and equally significant concerns over value-for-money and the extent of accessibility to what are often extremely expensive works funded largely by the taxpayer. Such concerns tie in well with worries about the putative audiences for print and/or Web editions. From the technical and political perspectives, there is no reason why most of what is a publicly funded project should not be made available to a greatly expanded circle of end users. It is important to note that there is an attendant obligation on managers of Web projects to inform the outside world that these resources exist—or else there is no point condemning traditional print editions for their

[15] For issues connected to the nature of edited texts and authorial intention see *inter alia* Thomas Tanselle, "Textual Instability and Editorial Idealism," *Studies in Bibliography* 49 (1996), pp. 1–60 which is available at <http://etext.virginia.edu/> (accessed 12 March 2002); for more on intention, see Tanselle, "The Editorial Problem of Final Authorial Intention," *Studies in Bibliography* 29 (1976), pp. 167–211.

miniscule readership. Ideally, anyone with the requisite technology should have access to what is an intrinsically fascinating and probably previously unpublished writing, along with a digitised image of the original, available in a form of display that can be customised by the same end user. Placing material online when it is ready—that is, legible, but not yet final-checked against the original—also means that the project can visibly prove to existing funders that the project is viable, and also give good reasons to potential supporters for funding further work.[16]

The availability of digitised images should also reassure scholarly end users about the reliability of any professedly 'final' transcription. These resources make it possible for many different sorts of end user, not simply members of the academic community, to suggest instances where a text has been mistranscribed. The committed user could, for example, point to cases where we have missed the fact that a page now in the Bronx actually follows a folio currently in Tokyo. Most significantly perhaps, the high quality of the images offers much more than either its potential to act as a validator for the transcription or its capacity to provide a representation of outstanding aesthetic appeal. Indeed, the availability of these resources gives an overall simplicity to the design of the project as a whole. Once the image exists then the function of the transcription necessarily changes so that rather than it being merely an end-in-itself, it becomes a "self-searching mechanism", or an instrument to return the end user to the "original". The transcription can always be called up and printed from the web page, copyright restrictions on its use permitting. It is worth noting here that scholars should retain a mild scepticism about the veridical nature of the image; this is so not only because different browsers display the image in different colours and to varying levels of accuracy, but because web managers have to engage in substantial image-compression (along with other techniques) to get the image to display to a reasonable standard. Finally, the existence of high quality images that to some degree function as the goal of the transcription-as-search mechanism, solves the problem of the potential instability of URLs, the online page reference that describes the location of an online page. Rather, the researcher can simply cite the standard institutional description of the MS., with some sort of acknowledgement to its being made available through the Newton Project.[17]

[16] The Newton Project and its funders are committed to the creation of a resource that is free to access at point of use. Some libraries and owners have expressed concerns about publishers making capital from downloading high quality images from websites; although the situation is complex, this issue can be dealt with according to existing copyright law. Charging fees for access to high quality images, as is practised by the Public Record Office on its 1901 Census website, is another model that could benefit owners of the physical documents, copyright holders, and indeed the Newton Project.

[17] It is worth pointing out that, to a limited extent, where there are complicated and detailed authorial alterations to text, the availability of digitised images can obviate the need for overly intricate editorial intervention at the level of representation/ display. Nevertheless, as much information as is feasible about the changes—not necessarily visible to the end-use—should be captured by the markup.

At the far end of the process, the e-project or edition has no definite chronological terminus as long as it continues to be hosted by an institution able and willing to safeguard its contents. For the duration of the AHRB project, Imperial College London has agreed to safeguard and support the Newton Project while its deposit in the AHDS will ensure longer-term viability. However, funding arrangements will almost certainly mean that certain portions of the archive have to be made available by a certain time and in a particular edited format. Despite the caveats about editorial hubris mentioned earlier, the unbounded temporal nature of the project is logically tied to the notion that the Newton Project should aim to provide an exhaustive rather than merely a comprehensive collection of papers. This does mean that we have to transcribe and tag text that has appeared in past print editions, but it is a price worth paying both to avoid intellectual property issues with the holders of the print copyright, and to create an integrated and coherent online environment. As we have seen, it is also technically feasible to add or build on simple links to annotations in books in Newton's library as well as to link to facsimiles of his published works or to secondary historical material created by historians or other analysts. In general it should be noted that the new process completely reverses the more traditional relationship between print and electronic representation. Thus, printed selections for a print edition can be generated fairly effortlessly from texts and scholarly apparatus already contained in the Web edition.[18]

A central goal is to place the online resource amongst a broader set of projects and collections that constitute a *digital library*. To do this, much, especially the choice of encoding schemes, has to be successfully decided upon at the start. Cooperation with other projects can usually only take place when basic standards and organisational infrastructures have been agreed. After this initial step, it is possible to develop the project more efficiently by allowing relevant teams to edit specific areas of Newton's work. For example, William Newman and others have just acquired funds to produce an edition of the alchemical papers, while a team headed by Ciriaca Morano, at the Consejo Superior Investigaciones Científicas of Madrid (CSIC), is producing transcriptions of all the Latin theological papers. The project can move in a

[18] At the time of writing, digital library collections form the central and lavishly funded grand vision of nearly all humanities computing projects in the U.S. and the E.U. Foremost amongst these is probably the U.S. Digital Libraries Initiative (DLI; see <http://www.dli2.nsf.gov> which contains lower level digital libraries such as the National (SMET) Digital Library (NSDL) and is sponsored by agencies such as the NEH, NSF, NASA, the Defense Advanced Research Projects Agency (DARPA) and the Library of Congress. More specifically, the Perseus Project (http://www.perseus.tufts.edu) has pioneered efforts to create a large scale digital library of classical Greek and more recently Roman writings; see G. Crane, "Extending a Digital Library: Beginning a Roman Perseus," *New England Classical Journal* 27 (2000), pp. 140–60. SMET stands for Science, Mathematics, Engineering and Technology (Education); one should apologise at this juncture for the proliferation of acronyms that often sound like criminal organisations from a James Bond film.

number of different directions. For example, commentators on aspects of the Newton Project could engage in mutual conversation from which, over time, a databank can be created that records a string of comments and replies made by experts and, indeed, the wider online community.[19]

The role of the editor of online resources is no longer that of the autocratic sovereign (if it ever was), but along with the other roles, Web-project editors still have to edit text. Even at the primary level of transcription, there are significant hidden editorial decisions made with every line of tagged text, while there are more obvious forms of editorial skill involved in the second phase that combines the provision of scholarly apparatus with integrated hyperlinking of apparatus and Newton text. Here, a mass of underlying code gives rise to a situation in which the end user ostensibly has complete control over when to access or search any text. However, despite the exhaustive selection of texts and resources that will be available longer term, and the apparent empowerment of the end user made possible by the search-engine and stylesheet, the disappearance of the autocratic hand of the editor is an illusion.[20]

Amongst other tasks, senior members of the Project have gained substantial expertise in the area of copyright (separate agreements are necessary for the nearly forty holders of Newton material), XML and XSL representation of marked-up data, textual theory, fundraising, co-operation with national, E. U. and U. S. partners—and of course, Newton, his work, and his contexts. As a project manager, the editor's role is now truly managerial, co-ordinating transcription, markup, web-design, web-development, and site maintenance (hosting large projects costs money), as well as copyright agreement and fundraising. Resources have to be found for training transcribers in XML and for dispatching editors to all parts of the globe to check transcripts against originals. Whereas consultants were brought in to implement technical procedures in the first stages of the project, the Newton Project has acquired the skills to keep this in-house, thereby exercising control and indeed quality control over the entire process. At no stage do we hand over our online work to an outside publisher, and indeed we have already reached a stage where no publishers have the combination of technical and historical skills that we possess.[21]

[19] See for example, Clifford Lynch, "Digital Collections, Digital Libraries and the Digitization of Cultural Heritage Information," *First Monday* 7 (May, 2002) <http://firstmonday.org/issue/issue 7_5/lynch/index.html> (accessed 17 May 2002).

[20] For thoughts about the edition/archive difference, see John Lavagnino, "Reading, Scholarship and Hypertext Editions," *Text* 8 (1996), pp. 109–24; Jerome McGann, "The Rossetti Archive and Image-based Electronic Editing," in R. J. Finneran, ed., *The Literary Text in the Digital Age* (Ann Arbor: University of Michigan Press, 1996), pp. 145–83; and McGann, "The Complete Writings and Pictures of Dante Gabriel Rossetti: A Hypermedia Research Archive," Institute for Advanced Technology in the Humanities (IATH), University of Virginia, <http://jefferson.village.virginia.edu/rossetti/rossetti.html> (accessed 8 June 1999.)

[21] The Newton Project is currently the European Coordinator of Cultural Heritage Language Technologies (CHLT), a joint EU/NSF project aiming to develop tools and applications for web-based projects in a

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At the time of writing we have transcribed and completed first-stage tagging of about sixty five percent of the theological manuscripts although these will only be released once the transcriptions have been checked by a second member of the project. As already stated, we will not place images online alongside their particular transcripts until the checked transcription has been compared with the original (ojindeed, theimage!). The EAD catalogue of non-scientific papers needs to be constantly upgraded to take account of newly available texts while we hope to make this compatible and mutually searchable with the electronic catalogue of Portsmouth and Macclesfield papers currently being developed at the Cambridge University Library. To avoid the problem of our current dependence on Internet Explorer 5.0+ as the monopoly browser, we implemented server-side transformations of XML to XHTML encoded text in April 2004.[22]

The creation of online resources is a necessarily collaborative endeavour because it is in no one's interests to pioneer sites whose platforms are incompatible with anyone else's. For this reason, communication with partners in other projects is a necessity and granting agencies are increasingly supporting joint projects that have high-quality, democratic objectives, with the creation of opensource software as a desideratum. Once the basic structure and organisation of the project has been agreed, fundraising is by far the most pressing problem for undertakings such as the Newton Project. There is funding available to further the development of the technically robust software we need for the Newton Project, but it is much harder to attract support to create the kind of high quality content that either is difficult to find online or is completely non-existent. Proprietary software inevitably plays some role in making projects like this possible but only activities that are partly or wholly fended off from commercial predation—e.g. the Wellcome Trust's support

multi-lingual environment. More broadly, it is seeking to address issues concerning the implementation of an infrastructure for digital library collections.

[22] There are also discussions about which texts should go online first and what sort of 'release schedule' is appropriate for the future. Copyright issues—such as the definition and scope of 'fair use' and 'fair dealing,' whether academics should hand over copyright to publishers, or the extent to which any academic 'work' is owned by an academic's institution—are highly relevant to the status of the materials in online projects. For cogent discussions of these issues in the wake of the U. S. Digital Millennium Copyright Act of 1998, see, amongst others, Henry Gladney, "Digital Dilemma: Intellectual Property," *D-Lib Magazine* (December, 1999) <http://www.dlib.org/dlib/december99/12gladney.html> (accessed 5 July 2002); Scott Bennett, "Authors' Rights," *Journal of Electronic Publishing* 5, no. 2 (December, 1999) <http://www.press.umich.edu/jep/05-02/bennett.html> (accessed 5 July 2002); John Willinsky, "Copyright Contradictions in Scholarly Publishing," *First Monday* 7, no. 11 (November, 2002) <http://www.firstmonday.dk/issues/issue7_11/willinsky/index.html> (accessed 2 January 2003); and, in particular, Ann Okerson, "Midnight in the Garden of Good and Evil: Academic Publishing, Copyright and Other Miasmas," a chapter in the American Academy of Arts and Sciences publication, "Transition to Paper," <http://www.amacad.org/publications/trans11.htm> (accessed 20 May 2002).

for the Sanger Institute's Human Genome Project—can maintain the basic freedoms and open access to information that have characterised academic research for hundreds of years. Although institutions such as the AHRB are generous in supporting projects such as ours, larger scale funding for showcasing the scientific papers online will almost certainly have to be drawn from private individuals or large corporations on a no-strings-attached basis.[23]

Longer term plans for the Newton Project include tailoring portions of the resources on the website to suit specialist audiences such as schools and undergraduate courses. The extensive range of his interests means that students could learn about the history of Newton, or about early modern Britain, or even about the science and mathematics that he created. A more radical departure would be to open up the production of resources on the site to include a much broader group of individuals, who might—for example—offer commentary on modern expressions of Newton's mathematical and scientific discoveries. This radical decentralisation of authority has been attempted in projects such as HyperNietzsche, where a broad range of individuals are invited to contribute translations and other primary sources to a site dedicated to Nietzsche and his works. Whatever form the Newton Project takes in the next few years will largely be determined by gigantic forces currently gathering strength in the scholarly world and beyond. The pressing issue then, as now, will be whether scholars, librarians, museums, universities, commercial interests, or nation-states have control over digital libraries and indeed cultural heritage in general.[24]

[23] The Wellcome Trust's Sanger Institute is primarily concerned with "furthering the knowledge of genomes, particularly through large-scale sequencing and analysis"; see, <http://www.sanger.ac.uk> For the Sanger Institute's policy on releasing data, see <http://www.sanger.ac.uk/Projects/releases-policy.shtml> and, for the Human Genome Project, see <http://www.sanger.ac.uk/HGP/>

[24] See in particular the online tutorial "Digitizing Wilfrid," from which the title of this paper was cribbed, at <http://www.jtap.ac.uk/reports/htm/jtap-027-2.html> For Hypernietzsche, which conceptually owes a debt to the pioneers of genetic criticism in 1960s France, see <http://www.fabula.org/genetique/hypernietzsche.php> As with any other online project, a site run as an entity that grows organically, with multiple editors/managers as akin to gardners, needs to consider how various previous manifestations of the site can be recorded and archived.

ESSAY 4

Was Newton a Voluntarist?[1]

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Introduction

In his preface to the second edition of Newton's *Principia*, Roger Cotes chastised Cartesian opponents of the Newtonian model of the universe, declaring that "the business of true philosophy is to derive the natures of things from causes truly existent, and to inquire after those laws on which the Great Creator actually chose, to found this most beautiful Frame of the World, not those by which he might have done the same, had he so pleased."[2] Cotes here implies that the radical freedom of the Deity to have established any pattern of natural laws which he pleased calls for the empirical investigation of nature, as opposed to the *a priori* theorising presumed to be characteristic of the Cartesian method. Because God was free to frame whatever laws of nature he thought fit, and was not constrained in his creative acts by human conceptions of rationality or perfection, only careful scrutiny of the empirical world would uncover the particular order of nature that God had chosen to instantiate. On Cotes's account, the untrammeled will of the Deity vindicates the natural philosophy of Newton, and counts decisively against the speculative natural philosophy of Descartes and his rationalist successors.

Cotes's suggestion that the empirical approach to nature in early modern England was directly informed by a set of theological commitments—

[1] I wish to express my thanks to those present at the original "Newton 2000" conference and to the anonymous reviewers of this volume for their helpful (it not always uncritical) comments. I am particularly grateful to James Force and Sarah Hutton for their patience and indulgence.

[2] *Isaac Newton's Mathematical Principles of Natural Philosophy and his System of the World*, trans Andrew Motte, ed. Florian Cajori (Berkeley: University of California Press, 1960), p. xxvii.

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 39–63.
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specifically that emphasis on the primacy of the divine will known as voluntarism—has subsequently found favour with a number of commentators.[3] It is now generally accepted that many of the major figures in seventeenth-century natural philosophy were theological voluntarists—Pierre Gassendi, Walter Charleton, Robert Boyle, Isaac Barrow, and, of course, Isaac Newton himself. That Newton was a theological voluntarist is virtually an article of faith amongst his most influential interpreters.[4]

In this paper I shall suggest that in spite of the impressive range of authorities prepared to bear witness to Newton's voluntarism, there is reason to doubt this identification. Part of the problem, as I shall attempt to demonstrate, is that "voluntarism" itself is a somewhat problematic designation. Indeed, I have argued elsewhere that the widely held thesis that seeks to establish connections between the rise of modern science and theological voluntarism is questionable.[5] The issue of Newton's voluntarism, then, is an interesting test case for this standard thesis about the emergence of experimental science, particularly on account of the fact that Newton is widely regarded as one of its most important exemplars.

Neither "voluntarism" nor "voluntarist theology" is a seventeenth-century term, but amongst historians of early modern science a broad consensus has emerged as to their meaning. In the context of discussions of seventeenth-century natural philosophy, voluntarism is typically associated with all or some combination of the following claims:

[3] See M. B. Foster, "The Christian Doctrine of Creation and the Rise of Modern Natural Science," *Mind* 43 (1934), pp. 446–68; J. E. McGuire, "Boyle's Conception of Nature," *Journal of the History of Ideas* 33 (1972), pp. 523–42; Francis Oakley, "Christian Theology and the Newtonian Science: The Rise of the Concept of Laws of Nature," *Church History* 30 (1961), pp. 433–5; John Henry, "Henry More versus Robert Boyle," in *Henry More (1614–87): Tercentenary Essays*, ed. Sarah Hutton (Dordrecht: Kluwer, 1990), pp. 55–76; James E. Force and Richard H. Popkin, *Essays on the Context, Nature, and Influence of Isaac Newton's Theology* (Dordrecht: Kluwer, 1990); P. M. Heimann, "Voluntarism and Immanence: Conceptions of Nature in Eighteenth Century Thought," *Journal of the History of Ideas* 39 (1978), pp. 271–83; Margaret J. Osler, "Fortune, Fate, and Divination: Gassendi's Voluntarist Theology and the Baptism of Epicureanism," in *Atoms, Pneuma, and Tranquility: Epicurean and Stoic Themes in European Thought*, ed. Margaret J. Osler (Cambridge: Cambridge University Press, 1991); Margaret J. Osler, "The Intellectual Sources of Robert Boyle's Philosophy of Nature," in *Philosophy, Science, and Religion, 1640–1700*, ed. Richard Ashcroft, Richard Kroll, and Perez Zagorin (Cambridge: Cambridge University Press, 1991); Margaret J. Osler, *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World* (Cambridge: Cambridge University Press, 1994); Antoni Malet, "Isaac Barrow on the Mathematization of Nature: Theological Voluntarism and the Rise of Geometrical Optics," *Journal of the History of Ideas* 58 (1997), pp. 265–87.

[4] See, e.g., B. J. T. Dobbs, *The Janus Faces of Genius: The Role of Alchemy in Newton's Thought* (Cambridge: Cambridge University Press, 1991), p. 110; Osler, *Divine Will and the Mechanical Philosophy*, p. 151; Matt Goldish, *Judaism in the Theology of Isaac Newton* (Dordrecht: Kluwer, 1998), p. 159; James E. Force, "The God of Abraham and Isaac (Newton)," in James E. Force and Richard H. Popkin, eds., *The Books of Nature and Scripture* (Dordrecht: Kluwer, 1994), pp. 179–200, esp. p. 183; E. A. Burtt, *The Metaphysical Foundations of Modern Science* (Atlantic Highlands: Humanities Press, 1952), p. 294.

[5] Peter Harrison, "Voluntarism and Early Modern Science," *History of Science* 40 (2002), pp. 63–89.

1. The divine will has primacy over the divine intellect, and is unconstrained by considerations of goodness and wisdom.
2. The divine will is arbitrary.
3. The universe is directly dependent on the will of God.
4. God's activity in the world is not restricted by the laws that he has ordained (by his *ordinate power*), for he can miraculously intervene in nature at will (through an exercise of his *absolute power*).

Newton, I shall suggest, did not subscribe to (1). He may have held (2) and (3), but in doing so he was simply asserting what virtually every other seventeenth-century philosopher held, including those not usually numbered amongst the voluntarists. As for (4), Newton did believe in miracles, but he did not understand them to be violations of divine laws, nor did he regard them as resulting from an exercise of God's absolute power.

Voluntarism and Intellectualism

In the clearest and least ambiguous case, voluntarism is contrasted with intellectualism. Intellectualists hold that God's will is constrained by his wisdom and goodness; whereas voluntarists are said to hold that God's will is not so constrained. Margaret Osler expresses the distinction in this fashion: "Voluntarists stress the primacy of God's will over his intellect, and intellectualists emphasize God's intellect over his will."[6] When this distinction emerged in the middle ages it was its moral implications that were regarded as most significant. As Brian Leftow observes: "Applied to thinking about God's actions, voluntarism led late medieval philosophers to see the world's causal and moral values as firmly rooted in God's sheer free choice, and to take God's commands as the source of moral obligation."[7] On this account, for the voluntarist, divine moral imperatives are right simply because God had willed them; for the intellectualist, God had willed moral imperatives because they are right. Thus, for example, voluntarists considered murder to be wrong because God had forbidden it, whereas for intellectualists, God had forbidden murder because it was wrong. In the first instance, God's willing makes it wrong; in the second God's willing conforms to some universal moral standard.[8] These positions

[6] Osler, *Divine Will and the Mechanical Philosophy*, p. 17. Cf. Henry Guerlac, "Theological Voluntarism and Biological Analogies in Newton's Physical Thought", *Journal of the History of Ideas* 44 (1983), pp. 219–229 (esp. p. 227).

[7] Brian Leftow, *Routledge Encyclopaedia of Philosophy*, 10 vols, ed. Edward Craig (London: Routledge, 1998) 9:633a.

[8] Thomas Aquinas is generally regarded as the prototypal intellectualist: "God produces his effects according to his wisdom. For the will is moved to act from some kind of apprehension and the apprehended good is indeed the object of the will." *Summa contra gentiles* II, 24.1–2. Duns Scotus may be taken as an example of voluntarism: "anything other than God is good because God wills it, and not *vice versa*." *Opus Oxoniense* III, 19. For Scotus, nonetheless, some acts are naturally good or bad, inasmuch as they tend to

are also thought to have significant epistemological implications. Voluntarists held that knowledge of moral laws required recourse to divine revelation. Intellectualists thought that they could be known independently, through the exercise of reason or, to put it another way, by an appeal to natural law. The logic of this position as it might be applied to the laws of the physical universe is thought to follow in this fashion. If God's willing of laws of nature had been necessitated by rational or moral considerations, then there was a possibility that their nature could be intuited through the exercise of reason. If, however, these laws were arbitrarily imposed on the creation, they could be discerned only through direct (that is, empirical) knowledge of nature. The voluntarist position thus understood is also suggestive of a Deity whose decrees are arbitrary, inasmuch as they are prior to rational or moral considerations. For this reason, the language of God's "arbitrary decree," common amongst seventeenth-century English natural philosophers, is often taken to indicate adherence to a voluntarist theology.

When we consider Newton's position on moral truths in light of this understanding of voluntarism, however, he seems to be firmly on the side of the intellectualists. In the unpublished manuscript "On the Church," for example, he sets out his vision of a Christian religion based upon charity. The law of charity, Newton argues, was a universal law of nature, based on divine reason:

> The law of the Jews & Christians except the ceremonial part, was one & y^{e} same law. Thou shalt love the Lord thy God with all the heart & with all thy soul & with all thy mind. This is the first & great commandment & the second is like unto it: Thou shalt love thy neighbour as thyself. On these two commandments, saith Christ, hang all the Law & the Prophets, Matt 22.37. And on these two also depends all the Gospel. *For these are the laws of nature, the essential part of religion which ever was and ever will be binding to all nations, being of an immutable eternal nature because grounded upon immutable reason.*[9]

Here Newton grounds moral obligation both in the revealed commands of God and in the natural order. But in this instance revelation serves only to reinforce natural law. The commandments to love are thus "laws of nature" the origin of which lies in God's immutable reason. In terms of the standard distinction between voluntarists and intellectualists on the moral question, Newton seems here to align himself with the latter, for whom God's willing of moral norms is determined by his reason. A second manuscript source reinforces this interpretation. Newton declares that God "is one

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perfect human nature or corrupt it. William of Ockham, the other standard exemplar of voluntarism, has a similarly nuanced moral theory.

[9] MS Bodmer, ch. 1, 4r–5r (my emphasis.) Cf. *Irenicum or Ecclesiastical Polyty tending to peace*, Keynes MS 3, fol. 5.

substance, . . . freely willing good things . . . and constantly cooperating with all things according to accurate laws, as being the foundation and cause of the whole of nature, except where it is good to act otherwise."[10] God thus wills good things—things are not good because God wills them. Moreover goodness, not God's inscrutable will, is the principle upon which God operates in nature, and in terms of which apparent violations of natural order are to be understood.

If these passages are representative of Newton's position, then it is not unreasonable to conclude that he was not a voluntarist with respect to the origin of moral laws. Further evidence in support of this conclusion comes from the views of the Newtonian theologian Samuel Clarke, whom Newton regarded as a faithful enough spokesman to represent him in the controversy with Leibniz. In a sermon entitled "Of the Immutability of God," Clarke wrote that "in his *Laws* likewise, that is, in the uniform intention of all his Commandments, God is perfectly *unchangeable* because they are founded upon the same immutable *reasons*."[11] Like Newton, he stresses that the content of these commandments is the same in the "Law of Nature," "the Law of Moses," and the "Gospel of Christ."[12] God's moral laws are constant and eternal, because they are informed by his immutable reason.

Regarding moral laws, then, Newton appears to align himself with the intellectualists rather than the voluntarists, if we are to use those terms. This is not surprising, for in the seventeenth century most philosophers and theologians rejected a voluntarist understanding of the content of moral imperatives.[13] The most notable exception was Descartes, who notoriously asserted that all laws, moral and natural, depended on a divine will that was not informed by prior moral or rational considerations. The contrast between Newton's position and Descartes assertions about divine indifference is quite striking:

> If anyone attends to the immeasurable greatness of God he will find it manifestly clear that there can be nothing whatsoever which does not depend on him. This applies not just to everything that subsists, but to all order, every law, and every reason for anything's being true or good. If this were not so, then, as noted a little earlier, God would not have been completely indifferent with respect to the creation of what he did in fact create. If some reason for something's

[10] Gregory MS 245, fol. 14a, in J. E. McGuire, "Force, Active Principles, and Newton's Invisible Realm," p. 190.

[11] Clarke, "Of the Immutability of God," *The Works of Samuel Clarke, D.D.*, 2 vols (London, 1738), 1:41.

[12] Ibid.

[13] It may be possible to speak of a more moderate version of voluntarism according to which the content of moral imperatives is given in universal reason, while the *obligation* to conform to them is grounded in the fact that God commanded them. However it is not clear that Newton adopted this mitigated voluntarism either.

> being good had existed prior to his preordination, this would have determined God to prefer those things which it was best to do. But on the contrary, just because he resolved to prefer those things which are now to be done, for this very reason, in the words of Genesis, "they are very good"; in other words, the reason for their goodness depends on the fact that he exercised his will to make them so.[14]

A more unambiguous statement of theological voluntarism, at least as defined in terms of senses (1)–(3) above, would be difficult to find. Indeed, taken together with other statements about the divine creation of eternal truths, this passage shows Descartes to have been the most extreme voluntarist of his age.[15] The Cartesian position generates some difficulties for the view that links theological voluntarism with the emergence of experimental science, and indeed has led some commentators to deny that Descartes is a voluntarist.[16] However, this is not the context in which to pursue a detailed account of Descartes' position, a position generally acknowledged to be unique and perplexing.[17]

For the moment it can be concluded that Newton does not seem to be a voluntarist with respect to God's willing the content of *moral* laws. However, it might yet be the case that in the sphere of *physical* laws, God's will was unconstrained by rational or moral considerations. The physical laws of nature might thus be arbitrary in a way that moral laws were not.

[14] René Descartes, *Objections and Replies*, in *The Philosophical Writings of Descartes*, 3 vols, ed. John Cottingham, Robert Stoothoff, and Dugald Murdoch (Cambridge: Cambridge University Press, 1984–91), 2:293.

[15] For the creation of eternal truths see Descartes to Mersenne, 15 April 1630, in *Philosophical Writings*, 3:23; *Objections and Replies*, in *Philosophical Writings*, 2:291.

[16] Margaret Osler has suggested that Descartes was not a voluntarist, *Divine Will and the Mechanical Philosophy*, pp. 11, and 146–52. However, virtually all Descartes scholars accept this identification. Part of this is a disagreement over definitions. The basic issue is how Descartes' extreme voluntarism with respect to God's willing of eternal truths is to be squared with his apparent intellectualism. See, e.g., Amos Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century* (Princeton: Princeton University Press, 1986), pp. 179–92. Funkenstein concludes, rightly in my view, that Descartes' rationalism is anchored not in his ontology, but in his epistemology (p. 186). For discussions of Descartes' position in relation to the voluntarism and science thesis, see Harrison, "Voluntarism and Early Modern Science," and Edward B. Davis, "Christianity and Early Modern Science: The Foster Thesis Reconsidered," in *Evangelicals in Historical Perspective*, ed. David N. Livingstone, D. G. Hart, and Mark A. Noll (Oxford: Oxford University Press, 1999), pp. 75–95.

[17] There is a vast literature on this issue. For the range of interpretations see Dan Kaufman, "Descartes's Creation Doctrine and Modality," *Australasian Journal of Philosophy* 80 (2002), pp. 24–41; Thomas M. Lennon, "The Cartesian Dialectic of Creation," in *The Cambridge History of Seventeenth-Century Philosophy* 2 vols., D. Garber and M. Ayers (Cambridge: Cambridge University Press, 1998), 1:331–62; E. M. Curley, "Descartes on the Creation of Eternal Truths," *The Philosophical Review* 93 (1984), pp. 569–97; Harry Frankfurt, "Descartes on the Creation of Eternal Truths," *The Philosophical Review* 86 (1977), pp. 36–57. In relation to the issue at hand, see the discussion in Funkenstein, *Theology and the Scientific Imagination*, pp. 179–92.

God´s Arbitrary Will

Newton's putative voluntarism is often characterised, in part, as an assertion that God wields an arbitrary power.[18] On the face of it, it may seem as if the contention that God's decrees are arbitrary is inconsistent with the assertion that his willing is informed by considerations of goodness and wisdom. Statements to the effect that God's willing is in certain instances arbitrary are thus often taken to be indicative of a voluntarist, rather than an intellectualist stance. However, Samuel Clarke whom, as we have seen, held that God's will is informed by moral considerations, insisted at the same time that the "manner of acting" of God's will is "perfectly arbitrary", and that the laws of nature are "merely by arbitrary constitution."[19] Surprising as it may seem, such a position was held by many early modern theologians and philosophers, including Newton. To assert that God's will might on occasion be arbitrary, I hope to show, is not an infallible indication of a voluntarist commitment.

What lies behind the seemingly inconsistent assertion of both an intellectualist position with respect to moral decrees *and* the insistence that God's willing might in other respects be arbitrary was the conviction that many features of the universe were morally neutral or "indifferent." As Cambridge Platonist Ralph Cudworth expressed it: "arbitrary and contingent liberty is not quite excluded from the Deity by us, there being many cases in which there is no best, but a great scope and latitude for things to be determined either this way, or that way, by the arbitrary will and pleasure of God Almighty. As for instance, the world being supposed to be finite (as it could no more be infinite than it could be eternal), that it should be just of such a bigness, and not a jot less bigger, is by the arbitrary appointment of God."[20] Cudworth proceeds to provide further examples of cosmic parameters—the number of stars, the number of angels, the number of human souls—that are determined by God's arbitrary will. Yet Cudworth was insistent, against Descartes' moral voluntarism, that "there is a nature of goodness, and a nature of wisdom antecedent to the will of God, which is the rule and measure of it."[21]

On the Continent a similar view was articulated by the philosopher-theologian Nicolas Malebranche. While Malebranche was in no doubt that

[18] Thus, e.g., John Henry: "Newton being a voluntarist (who emphasized God's arbitrary will and held him to free to make any kind of world he chose) and Leibniz a necessitarian or intellectualist (who held God's reason to be his primary attribute) and who believed, therefore, that God was constrained by coeternal rational and moral principles to create only this world—which must be the best of all possible worlds." John Henry, s.v. "Causation," in *The History of Science and Religion in the Western Tradition: An Encyclopedia* ed. Gary Ferngren (New York: Garland, 2000), p. 35.

[19] Clarke, "The Evidences of Natural and Revealed Religion," *Works*, 2:698.

[20] Ralph Cudworth, *A Treatise of Freewill*, in *Treatise concerning eternal and immutable morality* with *A Treatise of Freewill*, ed. Sarah Hutton (Cambridge: Cambridge University Press, 1996), p. 189.

[21] Ibid., p. 187.

God had willed particular moral imperatives because they were good, he nonetheless suggested that the whole existence of the physical universe was a consequence of God's arbitrary decision:

> Actually, the existence of bodies is arbitrary. If there are any, it is because God willed to create them. Now, the same does not hold true of that volition to create bodies as holds true of the volitions to punish crimes and reward good deeds, to require love and fear from us, and so on. These and a thousand other similar volitions of God are necessarily contained in divine Reason, in that substantial law which is the inviolable rule of the volitions of the infinitely perfect Being, and generally of all intellects. But the volition to create bodies is not necessarily contained in the notion of the infinitely perfect Being.[22]

The volitions of God relating to the physical world, Malebranche insisted, cannot be known *a priori* from reason or from an examination of our concept of God, for "we cannot see His arbitrary volitions in necessary reason."[23] It is worth noting in passing that none of this moved Malebranche to endorse the empirical study of nature. Rather, the existence of bodies was established by revelation: "Thus, there is no way apart from revelation by which we can be assured that God has indeed willed to create bodies."[24]

It is instructive to contrast these positions with that of G. W. Leibniz, who was the most notable figure in the early modern period to deny the arbitrary nature of God's willing in relation to features of the physical universe. As is well known, Leibniz wished to argue that there must be a sufficient reason for the existence of the present world, namely, that it is the best possible world. This meant that God was in some sense obliged—"inclined but not necessitated" was Leibniz's careful formulation—to create the best.[25] Leibniz was thus forced to defend the view that nothing in the world was morally indifferent and, further, to assert that if it were the case that two incompatible things were equally good, God would produce neither of them.[26] In no instance, on this account, could God's willing be considered arbitrary, there always being a sufficient reason for any divine act. The voluntarist assertion that God's will

[22] Nicolas Malebranche, *Dialogues on Metaphysics and Religion*, ed. Nicholas Jolley and David Scott (Cambridge: Cambridge University Press, 1997), VI.v (p. 95).

[23] Ibid., I.v (p. 9). Cf. "the volitions of God relating to the world are not contained in the notion we have of him." Malebranche, *Dialogues*, VI.vi (p. 96).

[24] Ibid., VI.v (p. 95).

[25] See, e.g., G. W. Leibniz, *The Principles of Philosophy, or, the Monadology*, in *Philosophical Essays*, ed. and trans. Roger Ariew and Daniel Garber (Indianapolis and Cambridge: Hackett, 1989), pp. 220, 227; *Principles of Nature and Grace, based on Reason*, in *Philosophical Essays*, p. 210.

[26] Leibniz, *New Essays in Human Understanding*, II.27, ed. and trans. Peter Remnant and Jonathan Bennett (Cambridge: Cambridge University Press, 1981), p. 239; *The Leibniz-Clarke Correspondence*, ed. H. G. Alexander (Manchester: Manchester University Press, 1956), p. 39 (Leinbiz's fourth paper, 19).

is arbitrary can thus be interpreted as a rejection of the notion that God must have a sufficient reason for the creation.[27]

Leibniz's claim was one of the central issues in the Leibniz-Clarke correspondence, in which Samuel Clarke defended a range of Newtonian positions, including the assertion that certain features of the universe were established by an arbitrary decree. Clarke's argument was essentially the same as that of Cudworth and Malebranche:

> Undoubtedly nothing is, without a sufficient reason why it is, rather than not; and why it is thus, rather than otherwise. But in things in their own nature indifferent; mere will, without any thing external to influence it, is alone that sufficient reason. . . . for still it would be absolutely indifferent, and there could be no other reason but mere will, why three equal particles should be placed in the order *a, b, c*, rather than in the contrary order.[28]

Thus was Clarke to defend the kinds of speculations offered by Newton in the *Opticks*, that God was free to choose different dimensions for the fundamental particles of matter and thus to have instituted different laws of nature from those currently in operation.[29]

There was nothing particularly original in this defence of the Newtonian position, for it is important to understand that while the question that Leibniz posed—whether God must create the best world—was by no means a novel one, the answer he gave was. Aquinas, for example, had long before declared that in spite of the beauty and order of the present universe, God could have created a better one. It followed that God's decision to produce this particular universe was arbitrary. For the existence of certain features of the universe, Aquinas argued, no reason could be given other than the will of the creator. These features were thus contingent.[30] Aquinas's position is not usually thought to qualify him for enlistment in the ranks of the voluntarists. On the contrary, he is usually considered to epitomize intellectualism (as are Cudworth and Malebranche). It follows that the position of Newton and Clarke on God's arbitrary volitions, and their opposition to Leibniz on this point, was not exceptional and of itself does not count as evidence of their voluntarism.[31]

[27] Thus J.E. McGuire: "Voluntarist theology . . . denies that God must have a sufficient reason for creation." "Boyle's Conception of Nature," p. 527.

[28] *Leibniz-Clarke Correspondence*, p. 30 (Dr. Clarke's Third Reply, 2).

[29] Isaac Newton, *Opticks, or a Treatise of the Reflections, Refractions, Inflections & Colours of Light*, based on the 4th edn (New York: Dover, 1979), pp. 404ff.

[30] Aquinas, *Summa theologiae*, 1a. 25, 6; *Quaestiones disputatae de potentia Dei* 3.17. Also see Funkenstein, *Theology and the Scientific Imagination*, pp. 131f., 142, 201.

[31] Indeed, Amos Funkenstein has observed in this connection that "Newton's insistence on the arbitrariness-cum-perfection of creation resembles rather Aquinas [than Boyle]." *Theology and the Scientific Imagination*, 193, n. 2. Cf. p. 201.

In sum, neither the claim that God's willing with respect to the operations of nature is sometimes arbitrary, nor the insistence (in opposition to Leibniz) that God was free to have created other worlds, are reliable indicators of a voluntarist commitment. The arbitrariness of God's willing in the physical universe lies in the nature of the things being willed rather than in the manner of their willing.[32] As to the position of Leibniz, it was virtually unique, and thus there was nothing uniformly voluntaristic in the views of those who opposed it.

The Dependence of the World on the Divine Will

A third sense in which the term 'voluntarist' is used in discussions of Newton's views is to refer to the view that nature is totally dependent upon God's will. In an influential paper P. M. Heimann has written of Newton's "voluntarist doctrine of divine omnipotence" which he characterizes in this way: "everything in the world . . . is subordinate to him [God] and subservient to his Will." Margaret Osler has also defined voluntarism in a similar way: "Briefly, voluntarism is the view that creation is absolutely dependent upon God's will."[33]

There is little doubt that Newton and the Newtonians did stress the dependence of the created world on the will of the Deity. In Query 31 of the *Opticks* Newton described God as "a powerful, ever-living Agent, who being in all places is more able by his Will to move bodies within his boundless uniform Sensorium, and thereby to form and reform the parts of the Universe, than we by our Will to move the Parts of our own Bodies."[34] Elsewhere he was to speak of God's "creating, preserving, and governing of all things according to his good will," a specific instance of which was the "continual miracle" that was required "to prevent the sun and fixed stars from rushing together through gravity."[35] Roger Cotes agreed that the world had arisen "from nothing but

[32] It should be understood that the term "arbitrary" did not have the same negative connotations in the seventeenth century that it has acquired since. John Leonard writes that "'Arbitrary' is an especially treacherous word for the reader of seventeenth-century English, for the sense 'dependent on the discretion of an arbiter' was then more common than it has since become." *Naming in Paradise: Milton and the Language of Adam and Eve* (Oxford: Clarendon, 1990), p. 6. On the contemporary meanings of "arbitrary" see also Harrison, "Voluntarism and Early Modern Science," p. 74.

[33] Heimann, "Voluntarism and Immanence," p. 273; Osler, *Divine Will and the Mechanical Philosophy*, p. 11.

[34] Newton, *Opticks*, p. 403.

[35] Newton, MS Yahuda 21, fol. 1r.; Memoranda by David Gregory, May 1694, in *The Correspondence of Isaac Newton*, 7 vols, ed. H. W. Turnbull, J. F. Scott, A. R. Hall, and L. Tilling (Cambridge: Published for the Royal Society at the University Press, 1959–77), 3:336. Cf.: "it must be agreed that God, by the sole action of thinking and willing, can prevent a body from penetrating any space defined by Certain limits," in *Unpublished Scientific Papers of Isaac Newton*, ed. and tr. A. Rupert Hall and Marie Boas Hall (Cambridge: Cambridge University Press, 1962), p. 139. For the association of this view with Newton's voluntarism, see

the perfectly free will of God directing and presiding over all". Samuel Clarke argued in the same vein that "the *Course of Nature*, cannot possibly be any thing else, but the *Arbitrary Will and pleasure of God* exerting itself and acting upon Matter continually."[36]

Again, however, there was nothing distinctive about asserting the dependence of the world on the divine will, *per se*. To do so was merely to endorse an orthodox understanding of the doctrine of creation according to which God creates and sustains the world in one simple act. Aquinas, for example, had argued that God creates and preserves things by the same action, and that he thus gives existence to the creatures by his will.[37] Not surprisingly, then, views similar to those expressed by the Newtonians were commonplace amongst those not necessarily thought to endorse voluntarism. Malebranche held that the created order was directly dependent on God for its continued existence: "As the universe is derived from nothing, it depends to such an extent on the universal cause that, if God ceased to conserve it, it would necessarily revert to nothing."[38] All creatures, he asserted, "are essentially dependent on a free will of the creator."[39] In the created world, Descartes had also argued, bodies and intelligences "must depend on God's power in such a manner that they could not subsist for a single moment without him."[40] Further specifying that it is the dependence of the world on God's *arbitrary* will cannot serve as a distinctive marker for voluntarism either, because as we have already seen, the view that the divine will was arbitrary was also commonplace.

Perhaps the distinctively voluntarist position is that the world is *directly* dependent on the divine will—that there are no causal intermediaries or true secondary causes in the creation.[41] This seems to be Heimann's view, for he qualifies his definition of voluntarism by specifying that God acts on matter directly: for voluntarists God's will is "the only causally efficacious agency in nature."[42] There is a long-standing tradition that Newton held such a view

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James E. Force, "Newton's God of Dominion," in Force and Popkin, *Essays on the Context, Nature, and Influence of Newton's Theology*, pp. 85ff., and E. B. Davis, "Newton's Rejection of the Newtonian World View," *Science and Christian Belief* 3 (1991), pp. 103–17.

[36] Roger Cotes, "Preface" to *Isaac Newton's Mathematical Principles of Natural Philosophy*; Clarke, "The Evidences of Natural and Revealed Religion," *Works* 2:698.

[37] Aquinas, *Summa theologiae* 1a. 104, 1–3.

[38] Malebranche, *Dialogues* VII.8, p. 113. Cf. *The Search after Truth*, trans. and ed. Thomas Lennon and Paul Olscamp (Cambridge: Cambridge University Press, 1997), p. 450.

[39] Malebranche, *Treatise on Nature and Grace*, trans. Patrick Riley (Oxford: Clarendon, 1992), p. 162.

[40] Descartes, *Discourse on the Method*, in *Philosophical Writings*, 1:127. See also Daniel Garber, *Descartes' Metaphysical Physics* (Chicago: University of Chicago Press, 1992), pp. 274ff.

[41] Aquinas, asking whether God preserves each creature immediately, allowed that God had established a particular order of causes, of which he was the first. The creatures' dependence on God was thus mediated by secondary causes. *Summa theologiae* 1a. 104, 2.

[42] Heimann, "Voluntarism and Immanence," p. 273 . Cf. J. E. McGuire on Boyle's mechanical philosophy: "God's Will, therefore, is the only causally efficacious agency in nature." "Boyle's Conception of Nature," p. 525.

about the operation of gravity. Because of Newton's insistence that gravity was not an essential property of matter and that action at a distance was impossible, many commentators have read him as asserting that God is the agent who acts directly on matter to produce the effects of gravity. In a letter to Richard Bentley, Newton wrote that "gravity must be caused by an agent acting constantly according to certain laws, but whether this agent be material or immaterial I have left to consideration of my readers."[43] Bentley had already given this due consideration and determined that the relevant agent was in fact the Deity. In his 1691–2 Boyle Lectures, he announced that "all the powers of mechanism are dependent on the Deity," for "gravity, the great basis of all mechanism, is not itself mechanical, but the immediate *fiat* and finger of God, and the execution of divine law."[44] A number of influential Newton scholars thought that Newton himself probably understood gravity in this way, as the direct activity of God.[45]

Yet again it must be pointed out that the propensity to withdraw causal efficacy from natural objects and ascribe it to God was not peculiar to putative voluntarists. This tendency characterized much seventeenth-century natural philosophy. Its logical terminus is the doctrine of occasionalism, according to which God is the only genuinely efficacious causal power in the universe. Such a view is at least incipient in Descartes, and overt in Malebranche, Louis de La Forge, Gérauld de Cordemoy, and others.[46] There seems, then, to be a close connection between voluntarism and occasionalism. Occasionalism may be a component of a voluntarist view, or a logical implication of it. In

[43] Newton to Bentley, 25 February 1692, in *Correspondence*, 4:438.

[44] Richard Bentley, Boyle Lectures, Sermon IV, in *The Works of Richard Bentley, D.D.*, 6th edn., 3 vols., ed. Alexander Dyce (London, 1836), 3:74–5. William Whiston suggests something similar, arguing that the "Providence of God in the Natural World is not merely a Conservation of its being, or a Non-annihilation thereof; but a constant, uniform, active influence or Energy in all the Operations done in it." *A New Theory of the Earth* (London, 1696), p. 6. Elsewhere in this work, Whiston states that the "Effects of Nature" are nothing but divine power "acting according to fixt and certain Laws" (p. 211).

[45] See, e.g. Alexander Koyré, "Gravity an Essential Property of Matter," *Newtonian Studies* (Chicago: University of Chicago Press, 1968), pp. 149–63; I. B. Cohen, "Newton's Third Law and Universal Gravitation", *Journal of the History of Ideas* 48 (1987), pp. 571–93. For a summary of these interpretations see John Henry, "'Pray do not Ascribe that Notion to Me': God and Newton's Gravity," in *The Books of Nature and Scripture*, ed. Force and Popkin, pp. 123–47. Ernan McMullin frankly concludes that Newton seemed to have no clear and consistent position on this issue. *Newton on Matter and Activity* (Notre Dame: Notre Dame University Press, 1978), p. 104.

[46] On the Cartesians and occasionalism see Daniel Garber, "Descartes and occasionalism," in *Causation in early modern philosophy*, ed. Steven Nadler (University Park: Penn State University Press, 1993), pp. 9–26; Steven Nadler, "Occasionalism and the question of Arnauld's Cartesianism," in *Descartes and his contemporaries*, ed. Roger Ariew and Marjorie Grene (Chicago: University of Chicago Press, 1996), pp. 129–44; "Doctrines of explanation in late scholasticism and in the mechanical philosophy," p. 541, in *The Cambridge History of Seventeenth-century Philosophy*, I:513–52; Daniel Garber, "How God causes motion: Descartes, divine substance, and occasionalism", *Journal of philosophy*, 84 (1987), pp. 567–80; Andrew Pessin, "Does Continuous Creation Entail Occasionalism? Malebranche (and Descartes)," *Canadian Journal of Philosophy* 30 (2000), pp. 413–40, and "Descartes's Nomic Concurrentism: Finite Causation and Divine Concurrence," *Journal of the History of Philosophy* 41 (2003), pp. 25–49.

a survey of different versions of occasionalism in the seventeenth century, Desmond Clarke thus concludes that "occasionalism is a consequence of Cartesian voluntarism".[47] This association is not particularly helpful for those who would regard voluntarism as promoting an experimental approach to the natural world, and for whom Descartes' voluntarism is an anomaly to be explained away.

To add a further complication, there is now reason to doubt that Newton himself actually held to an occasionalist account of the operation of gravity. John Henry has recently suggested that for Newton gravity was a power or virtue that was "superadded" to matter by God.[48] Thus gravity was neither an essential property of matter, nor was it to be *directly* attributed to the constant and immediate activity of God. In the much quoted Query 31, for example, Newton speculates that "God was able to create particles of matter of several sizes and figures, and in several proportions to space, and perhaps of different densities and forces, and thereby to vary the laws of nature."[49] This implies that the laws of nature are not to be identified with God's direct activity, but rather follow from the properties he impresses on matter. It is not clear, in the long run, what this difference might amount to for an understanding of divine power, but it may be contrasted with the position of Boyle, for whom the laws of nature seem to be more directly dependent on the divine will. The "laws of motion", Boyle insists, "did not necessarily spring from the nature of matter, but depended on the will of the divine author of things."[50] Boyle held the view that the laws of motion do not inhere in matter, not even on account of divinely impressed properties. Rather, the regular motions of matter result from externally imposed laws that are in no way dependent on the "sizes and figures" of particles.[51]

[47] Desmond Clarke, "Casual Powers and Occasionalism from Descartes to Malebranche", in *Descartes' natural philosophy*, ed. Stephen Gaukroger, John Schuster, and John Sutton (London: Routledge, 2000), pp. 131–48, esp. p. 145.

[48] Henry, "God and Newton's Gravity." See also Daniel Garber, John Henry, Lynn Joy, and Alan Gabbey, "New Doctrines of Body and its Powers, Place, and Space," in *The Cambridge History of Seventeenth-Century Philosophy*, 1:553–623, in which it is concluded that "Newton was not an occasionalist" (1:605).

[49] Newton, *Opticks*, pp. 404ff.

[50] Robert Boyle, *The Christian Virtuoso*, in *The Works of the Honourable Robert Boyle*, ed. T. Birch, 2nd edn. (London, 1772), 5:521. I say that what this difference amounts to is not clear, for if God is atemporal and one takes his original creation and his ongoing preservation of the universe as aspects of a single act then the difference between Newton and Boyle would seem to lie only in a different way of thinking about this simple divine act.

[51] Robert Boyle, *Of the High Veneration Man's Intellect Owes to God*, in *Works* 5:140. Peter Anstey writes: "The point of comparison with Boyle is that for Newton the laws arise from the nature of matter, whereas for Boyle they are expressions of God's will. For Newton, matter has powers and the laws of nature are manifestations of those powers." *The Philosophy of Robert Boyle* (London: Routledge, 2000), p. 175. As in the case of Newton, there has been some discussion of Boyle's position on these questions. J. E. McGuire has suggested that Boyle is an occasionalist—"with respect to inanimate nature all causal action must originate with God"—although he is reluctant to use this terminology. "Boyle's Conception of Nature," p. 535, cf. p. 532. See also E. McCann, "Was Boyle an Occasionalist?," in *Philosophy, its History and*

Admittedly, for John Henry, this interpretation of Newton's position does not count against the claim that Newton subscribed to a voluntarist theology. In favour of this perspective it can be said that Newton's position moves him further away from Descartes and the Cambridge Platonists for whom bodies were essentially inert. By the same token, it also moves him away from Boyle and closer to Leibniz who is virtually the only other early modern natural philosopher to assert that bodies are active.[52] Of more direct significance for the argument of this paper is the fact that if voluntarism is understood to entail a commitment to some version of occasionalism, and if Newton believed that God had supperadded gravity to bodies, then Newton cannot be considered a voluntarist. The notion that the world is immediately dependent upon the divine will was held in a strong sense by odd bedfellows—Descartes, Malebranche, and possibly Boyle and Berkeley— but only in a mitigated sense by Newton. Once again, the label 'voluntarism' and its standard associations are not particularly helpful in distinguishing styles of early modern natural philosophy.

It is worth noting that one reason that supporters of the voluntarism and experimental science thesis may have stressed the dependence of the world on God as a criterion of voluntarism is that such a position might seem to be allied to the view that the operations of nature are contingent. "Dependence" thus becomes another way of speaking about "contingency".[53] Betty Jo Dobbs, for example, writes that "for the voluntarist the world is always *contingent upon* the will of God." The contingency of the world thus established can be contrasted with the necessitarian impulses of the "rationalists." However, this move involves an equivocation between two distinct senses of contingency—one that opposes it to necessity, and one that treats it as a synonym for dependence. If God's will is immutable, as it is on the classical model,

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Historiography, ed. A. J. Holland (Dordrecht: Reidel, 1985), pp. 229–31; Struan Jacobs, "Laws of Nature, Corpuscles, and Concourse: Non-Occasionalist Tendencies in the Thought of Robert Boyle," *Journal of Philosophical Research* 19 (1994), pp. 373–93; T. Shanahan, "God and Nature in the Thought of Robert Boyle," *Journal of the History of Philosophy* 26 (1988), pp. 547–69; Anstey, *Philosophy of Robert Boyle*, pp. 158–86, and "Boyle on Occasionalism: An Unexamined Source," *Journal of the History of Ideas* 60 (1999), pp. 57–81. Cf. Pessin, "Descartes's Nomic Concurrentism."

[52] "Many will follow Descartes in holding that body is by its nature inert, and its motion and activity must come from without; such are the occasionalists of the Cartesian school, as well as philosophers like Henry More, who saw the mechanical philosophy as an argument for the existence of incorporeal substance. On the other side are those, Newton and Leibniz most visibly, but probably also Spinoza, who argued for a world of bodies in themselves active." Garber et al., "New Doctrines of Body", p. 580. For differences between Henry More, Descartes, and Boyle, see Margaret J. Osler, "Triangulating Divine Will: Henry More, Robert Boyle, and René Descartes on God's Relationship to the Creation", in *Stoicismo e origenismo nella filosofia platonica del Seicento inglese*, ed. Mariliusa Baldi (Milan: Franco Angeli, 1996), pp. 75–87.

[53] Dobbs, *Janus Faces of Genius*, p. 110 (my emphasis). Lisa Sarasohn similarly describes Gassendi's voluntarism as the view that "the world is absolutely contingent on God's will". *Gassendi's Ethics* (Ithaca: Cornell University Press, 1996), p. 15. For a further discussion of this point, see Harrison, "Voluntarism and Early Modern Science", esp. pp. 67–70.

then from the radical dependence of the natural world on God's immutable will follows the necessity of all that takes place in it. This was the logic that underpinned the theological determinism of Augustine, Luther, and their early modern successors.[54] Samuel Clarke, as we have already seen, asserted that the course of nature was nothing other than the arbitrary will of God acting on matter continually.[55] It followed, Clarke believed, that nothing in nature could be genuinely contingent, for the divine will was immutable: "As God is unchangeable in his essence and in the general perfections of his nature, so is he also in the particular decrees and perfections of his will, and so likewise in his laws, in his promises, and in his threatenings." These admittedly do not rest upon "the same ground of natural necessity," but they are in effect necessary on account of the immutability of the divine will.[56] In none of this is there any implication that the operations of nature can be known *a priori*, for human minds cannot comprehend the inscrutable decrees of the divine will. But it does not follow that the divine will is subject to change, nor, as we shall see below, that God might be free in any significant sense to over-rule his own eternal decree.[57]

Voluntarism, God´s Absolute Power, and the Miraculous

A fourth and final application of the term 'voluntarism' to Newton's thought is associated with the claim that Newton subscribed to a particular understanding of God's absolute power, which he is said to have inherited from the medieval nominalists, by way of the theology of Protestant reformers. The relevant medieval distinction is to do with the absolute and ordained powers of God—*potentia dei absoluta et ordinata*. Secondary sources differ slightly in their account of this distinction and its relevance for an understanding of voluntarism, but the general argument goes something like this. According to the usual medieval understanding, considered in terms of his *absolute power*

[54] Luther thus insisted that "all things happen by necessity" because God "forsees, purposes, and does all things by an immutable, eternal, and infallible will." Martin Luther, *D. Martin Luthers werke: kritische Gesammtausgabe* (Weimar: Böhlaus, 1883–), 123 vols, 18:617, 615.

[55] Clarke, *Works*, 2:698.

[56] Ibid., 1:40. Compare Matthew Hale's observation that, "in reality there is nothing in the World Contingent, because every thing that hath bin, is, or shall be, is praedetermined by an Immutable Will of the First Being, that is, by what God ordains." *A Discourse of the Knowledge of God, and of Our Selves* (London, 1688), pp. 33ff.

[57] All of this is to say that there are different notions of necessity—'logical', 'nomic', and more recently, 'metaphysical'. Only the first presupposes relations that can be known *a priori*. In the cases of both nomic necessity and metaphysical necessity some recourse to the empirical world is required. There is no need, then, to assume that those promoting an experimental approach to the natural world would do so on the basis of a conviction that there were non-necessary relations in nature. The import of Margaret Osler's suggestion that intellectualism is that view "that there are some elements of necessity in the creation" (*Divine Will and the Mechanical Philosophy*, p. 11) will thus depend on the kind of necessity being referred to.

God was free to have created any of a range of possible worlds, or even none. His *ordained power* relates to the fact that he had limited his absolute power by ordaining one specific order. God's absolute power was postulated to preserve a theoretical omnipotence, but this power, on the classical understanding, was never exercised. All events in the present order, including the unusual and miraculous, were taken as falling within God's ordained power.[58] Some late medieval thinkers, however, thought it improper to regard God as being eternally constrained by what he had ordained. They proposed an 'operationalised' understanding of God's absolute power, moving it from the realm of theoretical possibility to actuality. Thus it was argued that God could, as it were, override what he had ordained, by a present exercise of his absolute power.[59] It is this radical, operationalised view of God's absolute power that some commentators associate with early modern voluntarism. Newton and other putative early modern voluntarists, however, do not make reference to the distinction between God's absolute and ordained powers. Instead, it is argued, they utilised an equivalent distinction between God's 'extraordinary' and 'ordinary providence'. On this view, the laws of the natural world are considered to be God acting according to his ordinary providence (*potentia ordinata*), while his miraculous interventions into that order are thought of as the direct exercise of his *extraordinary* providence (*potentia absoluta*).[60] The Protestant reformers are posited as having provided an important link in the chain of historical influence and are usually supposed to have served as the conduit through which the medieval power distinction found its way into the modern world.[61]

Betty Jo Dobbs, who perhaps did most to promote this reading of Newton, thus wrote that the medieval power distinction "guided Newton and many of his contemporaries when they inquired into the relationships between God and the world, and it is now widely recognised that Newton and Newtonian science were deeply indebted to voluntarist theology and to the struggle to define God's ordained and absolute powers." The influence of the medieval power

[58] Aquinas, *Summa theologiae*, 1a. 25, 5.

[59] On the distinction and its history see Funkenstein, *Theology and the Scientific Imagination*, pp. 117–201; Lawrence Moonan, *Divine Power: The Medieval Power Distinction up to its Adoption by Albert, Bonaventure, and Aquinas* (Oxford: Clarendon, 1994); Francis Oakley, "The Absolute and Ordained Power of God in Sixteenth- and Seventeenth-Century Theology," *Journal of the History of Ideas* 59 (1998), pp. 437–61; Oakley, "The Absolute and Ordained Power of God and King in the Sixteenth and Seventeenth Centuries: Philosophy, Science, Politics, and Law," *Journal of the History of Ideas* 59 (1998), pp. 669–89; William Courntenay, *Capacity and Volition: A History of the Distinction of Absolute and Ordained Power* (Bergamo: P. Labrina, 1990).

[60] For a description of these developments see Eugene Klaaren, *Religious Origins of Modern Science* (Grand Rapids: Eerdmanns, 1977), esp. pp. 35–8.

[61] Klaaren, *Religious Origins of Modern Science*, pp. 39–52; Dobbs, *Janus Faces of Genius*, p. 111; Oakley, "Christian Theology and the Newtonian Science," p. 448; "The Absolute and Ordained Power of God in Sixteenth- and Seventeenth-Century Theology," p. 452.

distinction, according to Dobbs, "continued throughout the seventeenth century, often under the rubric of 'ordinary' and 'extraordinary' providence."[62] Francis Oakley, an authority on the medieval power distinction and its early modern influence, also suggests that this idea is to be found in the equivalent seventeenth-century expression "ordinary and extraordinary providence."[63] Oakley follows Dobbs in claiming that the distinction was important for Newton and other early modern natural philosophers: "there appears to be a growing disposition amongst historians of science to embrace the idea that 'the theological framework of *potentia dei absoluta et ordinata* guided Newton and many of his contemporaries when they inquired into the relationship between God and the world'."[64]

There are a number of difficulties with this account. The claim that some late medieval thinkers held the view that God might arbitrarily or capriciously change his mind is open to doubt, not least because such a view would seem to challenge the classical doctrines of divine simplicity and immutability.[65] More importantly, claims that the medieval power distinction was introduced into the modern era by the Protestant reformers are simply not supported by the evidence. Both Luther and Calvin explicitly rejected the distinction, and are thus unlikely to have served as agents for its propagation. Gordon Rupp points out that Luther's writings, from the first, "show a firm rejection of this very dialectic between the 'absolute power' and the 'ordained power' of God, and an emphatic concentration on what God has done."[66] Calvin can speak for himself: "What the Sorbonne doctors say, that God has an absolute power, is a diabolical blasphemy which has been invented in hell."[67] Calvin's

[62] Dobbs, *Janus Faces of Genius*, p. 111. So, too, Force, "Newton's God of Dominion," p. 85; McGuire, "Boyle's Conception of Nature," p. 526, n.8.

[63] Oakley, "Christian Theology and the Newtonian Science," p. 448; Oakley, "The Absolute and Ordained Power of God in Sixteenth- and Seventeenth-Century Theology," p. 452.

[64] Oakley, "The Absolute Power of God and King", pp. 677ff. Oakley gives his sources as Dobbs, *Janus Faces of Genius*, p. 110, and Force, "Newton's God of Dominion." For a slightly different reading of how the power distinction operated for Newton, see John Henry, "God and Newton's Gravity," pp. 123–47. For parallel arguments relating to Boyle and Gassendi, see McGuire, "Boyle's Conception of Nature," p. 526, and Margaret Osler, "Providence and Divine Will in Gassendi's Views on Scientific Knowledge," *Journal of the History of Ideas* 44 (1983), pp. 549–60.

[65] See, e.g., William J. Courtenay, "Nominalism and Late Medieval Religion," in *The Pursuit of Holiness in Late Medieval and Renaissance Religion*, ed. Charles Trinkaus with Heiko Oberman (Leiden: Brill, 1974), pp. 37, 42, 43, and *Capacity and Volition*, pp. 16–20; Eugenio Randi, "Ockham, John XXII and the Absolute Power of God", *Franciscan Studies* 46 (1986), pp. 205–16; Funkenstein, *Theology and the Scientific Imagination*, pp. 130–4. For an alternative view that identifies proponents of an operationalized absolute power see Justin Oakley, *Omnipotence and Promise: The Legacy of the Scholastic Distinction of Powers* (Toronto: Pontifical Institute of Mediaeval Studies, 2002), pp. 9–13.

[66] Gordon Rupp, *The Righteousness of God: Luther Studies* (London: Hodder and Stoughton, 1963), p. 91. See also Paul Althaus, *The Theology of Martin Luther* (Philadelphia: Fortress Press, 1966), pp. 282ff.; Richard Desharnais, "The History of the Distinction between God's Absolute and Ordained Power and its Influence on Martin Luther," 1966 PhD Dissertation, Catholic University of America, p. 248.

[67] John Calvin, *Sermons on Job*, in *Corpus Reformatorum* 34. 339 ff. Cf. Calvin, *Institutes of the Christian Religion*, III.xxiii.3, 2 vols, ed. J. McNeill, trans. Ford Lewis Battles (Philadelphia: Westminster, 1960),

specific concern was to deny that God's justice could somehow be separated from his power.[68] Furthermore, contemporary English theologians, on those occasions when they allude to the medieval power distinction, almost invariably interpret in the classical sense. A typical instance is Anglican Divine John Bramhall, who articulates the distinction in this way: "By his absolute power, he can do all things which do no implie imperfection or contradiction: but by his ordinate power he cannot change his decrees, nor alter what he hath ordained."[69] Finally, and following on from this latter point, there is no evidence that in seventeenth-century England the distinction between God's absolute and ordained power was regarded as somehow equivalent to that between his ordinary and extraordinary providence. Those theologians who make reference to both sets of distinctions clearly regard them as meaning quite different things. The Puritan divines William Perkins and William Ames plainly state that God's ordinary and extraordinary providence both operate within the confines of his ordained power. In other words, they assert that both the ordinary laws of nature and miraculous exceptions take place within what God has ordained from all eternity. Thus they place themselves within the classical reading of the medieval power distinction, and make no reference to an unrestrained power which is capricious and changeable.[70] If it were the case that Newton's thought had been informed by this medieval distinction in the operationalised sense, and if he had additionally thought of the standard ordinary-extraordinary providence distinction as equivalent to the power distinction, he would have been unique in seventeenth-century England in having done so.

2:950. On Calvin's rejection of the power distinction see David Steinmetz, *Calvin in Context* (Oxford: Oxford University Press, 1995), pp. 40–49; Anna Case-Winters, *God's Power: Traditional Understandings and Contemporary Challenges* (Louisville: Westminster, 1990), 42–63; François Wendel, *Calvin: Origins and Development of his Religious Thought*, trans. Philip Mairet (New York: Harper and Row, 1963), pp. 127ff. Cf. Oakley, "The Absolute and Ordained Power of God in Sixteenth- and Seventeenth-Century Theology," p. 457. Even the extent to which Calvin and subsequent Calvinists subscribed to voluntarism remains contentious. See, e.g., R. T. Kendall, *Calvin and English Calvinism to 1649* (London: Paternoster, 1997); Paul Helm, *Calvin and the Calvinists* (London: Banner of Truth, 1998); Norman Fiering. "Will and Intellect in the New England Mind," *William and Mary Quarterly* 29 (1972), pp. 515–58.

[68] "Therefore, since God assumes to himself the right (unknown to us) to rule the universe, let our law of soberness and moderation be to assent to his supreme authority, that his will may be for us the sole rule of righteousness, and the truly just cause of all things. Not, indeed, that absolute will of which the Sophists babble, by an impious and profane distinction separating his justice from his power—but providence, that determinative principle of all things, from which flows nothing but right, although the reasons have been hidden from us." *Institutes*, I.xvii.2 (I:214).

[69] John Bramhall, *Castigations of Mr Hobbes* (London, 1657), p. 46. Cf. p. 407.

[70] William Perkins, *A Golden Chaine, or, The Description of Theology* (London, 1621), pp. 17ff. Cf. *An Exposition of the Symbole or Creede of the Apostles* (London, 1611), p. 37. William Ames also notes that, "the father is and was able to haue [sic] created another world, yea a thousand worlds, but he would not, not will not." *The Marrow of Sacred Divinity* (London, 1642), p. 24. Cf. Oakley, "The Absolute and Ordained Power of God in Sixteenth- and Seventeenth-Century Theology," p. 459.

Why then, have Newton scholars found the medieval power distinction so attractive as an explanation of Newton's theological views, and why has it been regarded as one of the foundations of his voluntarism? There are several related reasons. First, it seems to make sense of certain passages in Newton's writings which are suggestive of God's having freely willed a specific order of nature into being from a range of possible options. The quotation from Cotes at the beginning of this paper seems to attribute such a view to Newton, and Newton's unpublished writings seem to confirm it. Thus in one of the Dibner manuscripts Newton speculates:

> Of God. What ever I can conceive wth out a contradiction, either is or may bee made by something that is . . . .
>
> Arg. 2. The world might have been otherwise then it is (because there may be worlds other then this) twas there noe necessary but a voluntary & free determination y^{t} should bee thus. And such a voluntary [cause must bee a God]. determination implys a God. If it be said y^{e} w^{ld} could bee no otherwise y^{n} tis because tis determined by an eternall series of causes, yts to pervert not to answer ye Ist prop. ffor I meane not y^{t} y^{e} [[world]] might have been otherwise notwth standing the precedent series of causes, but y^{t} y^{e} whole series of causes might from eternity have been otherwise here because they may be otherwise in other places.[71]

These musings are also reminiscent of the remark that Newton makes at the end of Query 31 in the *Opticks*, to which we have already alluded, according to which God could have made particles of matter of different sizes and figures.[72] On the face of it such passages seem to support the link between God's freedom in framing the laws of the universe and the experimental philosophy. As we have already noted, however, similar assertions about God's arbitrary volitions were advanced by Cudworth and Malebranche, neither of whom is usually regarded as a voluntarist on that account. Acknowledgement that God willed a particular natural order from a range of possibilities is not an unambiguous sign of adherence to a voluntarist theology. Moreover, even on the supposition that Newton's position is informed by something like an implicit power distinction, there is nothing in these passages that suggests anything other than the benign, classical understanding of the distinction.

A further reason that commentators consider the medieval power distinction to be illuminative of Newton's position regarding the will of the Deity is that it seems to make sense of his dual commitment, shared with other pious natural philosophers, to the existence of laws of nature on the one hand and miraculous divine interventions on the other. There is also a superficial similarity between the two sets of distinctions, and God's extraordinary providence, now

[71] Dibner MS 1031 B, fol. 4v.
[72] Newton, *Opticks*, pp. 404f.

understood as his suspending or violation of his own laws, does sound very much like an exercise of absolute power which overrides an ordained order. Moreover, the notion of a presently operationalised absolute power seems to fit with the voluntarist emphasis on the unconstrained will and power of God.

All of this, however, relies on an erroneous identification of the *potentia dei ordinata* and 'ordinary providence.' Most medieval proponents of the power distinction interpreted it in the classical sense, holding that God never presently exercised his absolute power. They were not thereby committed to a denial of the possibility of miracles, however. Miracles were regarded as part of an eternal ordained plan, even though they were clearly events that were out of the ordinary. In other words, miracles were thought to take place within the sphere of the ordained power of God. Most probably it was the absence within the *potentia dei ordinata* of a formal distinction between the ordinary course of nature and the miraculous that gave rise to the later distinction between the two aspects of divine providence.[73]

In any case, Newton's own thoughts on the nature of the miraculous make no reference to the criterion of God's power, absolute or otherwise. Neither did his conception of 'miracle' rely on notions of violation or interposition. Rather, in Newton's own words, "miracles are so called not because they are works of God, but because they happen seldom, and for that reason create wonder. If they should happen constantly according to certain laws impressed upon the nature of things, they would be no longer wonders or miracles, but might be considered in philosophy as a part of the phenomena of nature notwithstanding that the causes of their causes might be unknown to us."[74] These conceptions are suggestive of a subjective view of miracles, in which the breach of a "law" of nature is only an apparent one. Laws of nature on this view are not identical with the divinely ordained order, but rather are human approximations of that order, derived *a posteriori* by observation and experimentation.[75] Moreover, since the causes of natural events are hidden from human observers, there is no way of knowing whether any particular event is caused directly by God or by the powers he has impressed into matter. Such a view of the miraculous is consistent with Newton's insistence in the *Principia* that natural philosophy should concern itself with discerning regularities in

[73] William Courtenay also offers this explanation. See "The Dialectic of Divine Omnipotence", p. 8, in *Covenant and Causality within Medieval Thought* (London: Variorum, 1984).

[74] *Sir Isaac Newton: Theological Manuscripts*, ed. H. McLachlan (Liverpool: Liverpool University Press, 1950), pp. 17ff. The criterion of unusualness had been proposed by Augustine and conditionally endorsed by Aquinas. See Augustine, *De civitate dei*, XXI.8, *De utilitate credendi*, 16.34, *Contra Faustum* XXVI.3; Aquinas, *Summa theologiae*, 1a. 105, 7. See also Lorraine Daston, "Marvelous Facts and Miraculous Evidence in early Modern Europe," *Critical Inquiry* 18 (1991), pp. 93–124; Peter Harrison, "Newtonian Science, Miracles, and the Laws of Nature," *Journal of the History of Ideas* 56 (1995), pp. 531–53.

[75] As J. E. McGuire himself has expressed it, for Boyle and others, "physical laws are categories imposed upon nature by the human mind in light of the observed regularities of experience, or of those experimentally produced." "Boyle's Conception of Nature," p. 525, cf. p. 536.

nature rather than speculating about causes. For this reason, miracles could only be distinguished from other events in terms of their affect on human observers.[76]

This Newtonian conception of the miraculous was defended by Clarke and provided the basis of his explanation to Leibniz as to why gravity was not inherently miraculous. For Clarke, the miraculous was not defined in terms of the immediate operation of God's power but, as Newton himself had suggested, was to do with whether the relevant event was unusual. Thus, the case of planets moving around the sun, because it was usual, was not miraculous: " 'tis no miracle whether it be effected immediately by God himself or mediately by any created power." On the other hand, an unusual event, such as a heavy body suspended in the air, "is equally a miracle, whether it be effected immediately by God himself, or mediately by any invisible created power."[77] It is precisely because no distinction could be made in the manner of operation of God's power that unusualness became the criterion of the miraculous. As Clarke explained to Leibniz: "There is nothing more extraordinary in the alterations he [God] is pleased to make in the frame of things than in his continuation of it." "Alterations" appear to us as miraculous only on account of their being out of the ordinary. They are not so for God. Elsewhere, Clark was to reinforce this view of the uniform nature of the exercise of the divine power: "absolutely speaking, in *This strict and Philosophical Sense*; either nothing is miraculous, namely, if we have respect to the Power of God; or, if we regard our own Power and Understanding, then almost *every thing*, as well what we call natural, as what we call supernatural, *is* in *this Sense* really miraculous; and 'tis only *usualness* or *Unusualness* that makes the distinction."[78] In short, any distinctions we make with respect to natural and miraculous events (and thus between ordinary and extraordinary providence) relate only to our own understanding and not to distinct powers of God.

Another passage from Newton's unpublished manuscripts, already cited in the second section of this paper, might also seem to hint at a Deity prepared to overrule his ordained order. God acts "according to accurate laws . . . *except where it is good to act otherwise*."[79] This might be read as God's overturning of his own ordained order, but such a reading confuses two different conceptions of ordained laws. There are eternal and unchanging moral laws, to which God conforms his will. Regarding the apparently lawful operation of the physical world, God directly wills both the apparent regularities and the apparent exceptions, but does so on the basis of his wisdom and goodness.

[76] For an extended account of this conception of the miraculous see Harrison, "Newtonian Science, Miracles, and the Laws of Nature." For a contrasting interpretation see James E. Force's contribution to this collection.

[77] *Leibniz-Clarke Correspondence*, p. 35 (Clarke's Third Reply, 16).

[78] Clarke, *Works*, 2:697.

[79] Gregory MS 245, fol. 14a (my italics).

The "overriding" of physical laws of nature is not an abrogation of anything that God himself has ordained, but rather highlights the incompleteness of human understanding. Once again, such a view of divine operations was not uncommon, and was not restricted to those typically regarded as voluntarists. Nicolas Malebranche sets out precisely this view of the miraculous. "God", he writes, "can act only according to his reason; He depends on it in a sense—He has to consult and follow it." It is this reason that determines the timing of miracles: "God produces miracles only when the order He always follows requires it; I mean the immutable order of justice that He wills to render to His attributes." Such events may appear as willful interventions, but this is only because "His order and wisdom are often impenetrable abysses for the human mind." Malebranche readily concedes, as does Clarke, that such a position abolishes "the distinction between the natural and supernatural, which is so widely accepted and which is established by universal assent of the learned."[80] Descartes, incidentally, espoused a similar view: "to occur 'naturally' is nothing other than to occur through the ordinary power of God, which in no way differs from his extraordinary power—the effect on the real world is exactly the same."[81]

In sum, Newton's understanding of the miraculous does not seem to call for even an implicit subscription to an operationalised view of the medieval power distinction, and he never makes reference to it. Luther and Calvin, moreover, are unlikely sources for the operationalised power distinction, or its more benign version. Even the non-equivalent distinction between God's ordinary and extraordinary providence Clarke regarded as a human construction that is in no way applicable to the divine power considered in itself. If subscription to an operationalized version of the power distinction is a criterion of voluntarism, it is not one that Newton can satisfy.

Conclusion

Was Newton a voluntarist? On the issue of moral imperatives he seems to have held, unlike Descartes and the medieval voluntarists, that God's will is informed by his goodness. He was not a voluntarist on this ground. Newton certainly did believe that the world depended on the will of God, and that God's will with regard to certain features of the universe was arbitrary. But if this is a criterion of voluntarism, most seventeenth-century thinkers, with the exception of Leibniz, fall under that description. As for the idea that God might presently exercise his absolute power in contravention of what he has

[80] *The Search after Truth* and *Elucidations of the Search after Truth*, trans. and ed. Thomas Lennon and Paul Olscamp (Cambridge: Cambridge University Press, 1997), Elucidations X, XV, pp. 614, 666, 667ff.
[81] Descartes, *Objections and Replies*, in *Philosophical Writings*, 2:293.

ordained from eternity, it is doubtful that even the terms in which this notion is framed would have been accepted by Newton. Neither was such a conception of the operation of the divine will relevant for Newton's understanding of miracles.

In the light of all this, perhaps more important than the question of whether Newton was a voluntarist is whether voluntarism is a helpful way of distinguishing theological motivations and natural philosophical commitments of this period. It would be perverse to deny that there are important differences between the theological commitments and natural philosophical approaches of Newton on the one hand, and those of Descartes or Leibniz on the other. It is not clear, however, that these differences are adequately captured by the notion "voluntarist". This is why under different aspects of the definition Newton is variously and confusingly aligned with the Cambridge Platonists and Malebranche against Descartes, with Descartes, Malebranche and Boyle against Leibniz, and with Leibniz against Boyle and Descartes. These associations suggest that there are problems with the way in which early modern voluntarism has been understood, particularly in relation to its purported connections with empiricism or experimental philosophy. Not only does Descartes's voluntarism count against the voluntarism and science thesis, but Malebranche, too, might also reasonably be regarded as a voluntarist (he is considered to be one by Oakley).[82] Neither was an enthusiastic promoter of experimental natural philosophy, although it can be conceded that Descartes' experimental practices were not always consistent with his theoretical commitments.

It might be that the voluntarism and science thesis has conferred a misplaced concreteness on the category "voluntarism" as it is used in discussions of early modern science. Part of the difficulty with this notion of voluntarism, and with determining who might be a voluntarist, lies in the fact that it is not an actors' category. The expression was coined in the late nineteenth century to describe the emphasis on the will that characterises the philosophy of Schopenhauer.[83] Since that time it has accrued a number of additional and not always consistent meanings, including the related senses in which it is used in connection with the emergence of modern science.[84] The secondary literature generated by the

[82] Oakley, "The Absolute Power of God and King", p. 678.

[83] *Die Religion in Geschichte und Gegenwart*, 3rd edn., 7 vols (Tübingen: Mohr, 1957–65), 6:1490b; *Oxford English Dictionary*, s.v. "voluntarism".

[84] In the mainstream philosophical literature, "voluntarism" means "doxastic voluntarism"—the view that choice plays a significant role in belief. This position is contrasted with evidentialism, according to which belief is determined by evidence. Theological voluntarism in this sense is another term for "fideism", which stresses the primacy of faith rather than reason. See *Dictionnaire de Théologie Catholique*, 15 vols. (Paris: Librairi Letouzey et Ane, 1903–50), Vol. 15, cols. 3313 ff.; *The New Catholic Encyclopaedia*, 17 vols. (New York: MacGraw-Hill, 1967–79), s.v. "Voluntarism."; *The Encyclopaedia of Philosophy*, 8 vols., ed. P. Edwards (London: Macmillan, 1968), 8:271; *The Cambridge Dictionary of Philosophy*, ed. Robert Audi (Cambridge: Cambridge University Press, 1995), p. 845a.

voluntarism and science thesis has led to a widespread assumption that there was a discrete set of theological commitments in the seventeenth century that both answer to the name 'voluntarism' and promoted an empirical approach to the study of nature. The recent coinage of the term is not an objection against it as such, and it seems to function reasonably well as a label for medieval positions that stress the primacy of will over intellect. However, if it does not unambiguously describe a discrete set of theological commitments that can be correlated with particular early modern natural philosophical approaches—and this is what I have suggested above—then perhaps it needs to be applied with more discrimination.

In the case of the medieval power distinction we have to do with a different kind of anachronism. A dialectical category that already by the end of the middle ages was understood in quite different ways is assumed to have survived the outright hostility of the Protestant reformers and to have informed the theological understandings of Newton and a number of his peers. This is in spite of the fact that most seventeenth-century natural philosophers expressed an inveterate dislike of the "caviling" distinctions of the scholastics and that none ever explicitly refer to it. In light of this, it is possible to reinterpret the remarks of Roger Cotes with which this paper begins, as a rejection of the kinds of speculation and hypothesizing that such theological distinctions were thought to engender. After all, the power distinction first gained wide currency following the 1277 condemnation of certain Aristotelian doctrines issued by Etienne Tempier, Bishop of Paris. The effect of the condemnation was thus to encourage counterfactual speculations about the kinds of universes that God might have willed into existence had he so chosen.[85] In this manner, metaphysical discussions of the extent of God's absolute power shaped the style of scholastic natural philosophical disputations. If some vestigial version of the medieval power distinction played any significant role in informing early modern natural philosophy, arguably it was in the 'speculative' philosophies of Descartes and Leibniz, who posited various possible or hypothetical worlds and argued for the existence of a single possible world based on rational considerations.[86] Cotes's remarks to the effect that true philosophy ought to concern itself with what God had actually done, rather than with what he may have done had he so chosen, might thus be read as a caution against the 'speculative natural philosophy' which during the second half of the seventeenth century

[85] Edward Grant, "The Condemnation of 1277, God's Absolute Power, and Physical Thought in the Late Middle Ages," *Viator* 10 (1979), pp. 211–44; *Planets, Stars, & Orbs: The Medieval Cosmos, 1200–1687* (Cambridge: Cambridge University Press, 1996), pp. 53ff. Article 34 of the Condemnation, to take a pertinent example, censured the notion that God could not have made a plurality of worlds had he so willed.

[86] Descartes, *The World*, in *Philosophical Writings*, 1:90; *Discourse on the Method*, in *Philosophical Writings*, 1:131; *Principles of Philosophy*, in *Philosophical Writings*, 1:255. Leibniz, *Philosophical Essays*, pp. 71, 220.

was increasingly contrasted with 'experimental natural philosophy'.[87] Ironically, this reading of Cotes would resonate rather nicely with Luther's reaction to the medieval power distinction—to reprise the characterisation of Gordon Rupp—"a firm rejection of this very dialectic between the 'absolute power' and the 'ordained power' of God, and an emphatic concentration on what God has done."[88]

[87] Newton himself contrasted "experimental philosophy" with "hypothetical philosophy," the latter being said to consist in "imaginary explications of things & imaginary arguments for or against such explications, or against the arguments of Experimentall Philosophers founded on induction. The first sort of Philosophy is followed by me, the latter too much by Cartes, Leibniz, & some others." *Correspondence*, 5:398–90. On the rhetorical significance of these categories, see Peter Anstey, "Experimental versus Speculative Natural Philosophy," in *Early Modern Natural Philosophy: Patterns of Change in the Culture of Natural Philosophy in the 17th Century*, ed. Peter Anstey and John Schuster, forthcoming.

[88] Rupp, *The Righteousness of God*, p. 91.

ESSAY 5

Providence and Newton's *Pantokrator*: Natural Law, Miracles, and Newtonian Science

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Newtonian Miracle Talk—Part I
Isaac Newton Talks About the Literal Occurrence of Miracles

Newton, the "Puritan Lad from Lincolnshire," believed in the literal truth of scripture regarding miracles. Thomas Burnet corresponded with Isaac Newton prior to the publication of the first Latin edition of Burnet's *Sacred Theory of the Earth* in 1681. In his reply, Newton strenuously objects to Burnet's willingness to ignore the literal words of Genesis in his pursuit of a comprehensive cosmogony.[1] Burnet's fanciful hypothesis of an original earthly

[1] A letter exists from Burnet to Newton which is dated 13 January 1680/1. Newton's reply to Burnet's letter of 13 January 1680/1 also exists and is dated simply January 1680/1. In this letter, Newton traces out a literal theory of scriptural interpretation. In his January letter to Burnet, Newton makes his most important initial 'conjecture' about the origin of the earth. Newton is generally sympathetic to Burnet's view that God created the earth through generally provident, secondary, mechanical causes such as earthquakes. He later writes, "Where natural causes are at hand God uses them as instruments in his works . . . ." Newton to Burnet, "January 1680/1," in *The Correspondence of Isaac Newton*, 7 vols, ed. H. W. Turnbull, J. F. Scott, A. R. Hall, and L. Tilling (Cambridge: Published for the Royal Society at the University Press, 1959–77), 2:334. Newton is a literalist because any sort of excessively allegorical reading (such as Burnet's) corrupts and distorts the message of God. In a manuscript fragment Newton writes that: "He that without better grounds then his private opinion or the opinion of any human authority whatsoever shall turn scripture from the plain meaning to an Allegory or to any other less naturall sense declares thereby that he reposes more trust in his own imaginations or in that human authority then in the Scripture . . . Hence is it and not from any reall uncertainty in the Scripture that Commentators have so distorted it; And this hath been the door through which all Heresies have crept in and turned out the ancient faith." Yahuda MS 1, 12r. published as Appendix A in Frank E. Manuel, *The Religion of Isaac Newton* (Oxford: Clarendon Press, 1974), pp. 118–9.

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 65–92.
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paradise, a pristinely smooth sphere without mountains or salty oceans, is difficult for Newton to accept given the literal words of Moses.[2]

Newton goes on to describe how he literally interprets the six days of creation and explains how his interpretation is perfectly congruent with the literal words of Moses if one properly understands the perspective which Moses adopts in drafting his prophetic vision.[3] Newton's view is that Moses depicts exactly what the common man, i.e., a "vulgar" witness, would have observed of the formation of the planets of the solar system from a limited human perspective in space and time as if he had "lived & seen ye whole series of wt Moses describes."[4] The key point in this letter is Newton's view that, while Moses' account is literally true, it is a description limited to what an ordinary observer would have seen had one been present. The import of this circumscribed perspective of Moses' imaginary 'vulgar' witness is that the Genesis story is not a narrative account of the creation of the whole universe but only of the development of the solar system as viewed from the earth.[5] Newton then goes on to describe the settling out of the earthly chaos

[2] For example, Newton writes that: "... in ye third day for Moses to describe ye creation of seas when there was no such thing done neither in reality nor in appearance me thinks is something hard ... if before ye flood there was no water but that of rivers, that is none but fresh water above ground, there could be no fish but such as live in fresh water & so one half of ye first days work will be a non entity & God must be put upon a new creation after ye flood to replenish one half of this terraqueous globe wth Whales & all those other kinds of Sea Fish we now have." Newton to Burnet, "January, 1680/1,"*Newton Correspondence*, 2:331–2.

[3] Newton writes that: "As to Moses I do not think his description of ye creation either Philosophical or feigned, but that he described realities in a language artificially adapted to ye sense of the vulgar. Thus where he speaks of two great lights I suppose he means their apparent, not real greatness. So when he tells us God placed those lights in ye firmament, he speaks I suppose of their apparent not of their real place .... So when he tells us of two great lights & the starrs made on ye 4th day, I do not think their creation from beginning to end was done ye fourth day nor in any one day of ye creation nor that Moses mentions their creation as they were physicall bodies in themselves some of them greater then this earth & perhaps habitable worlds ... Newton to Burnet, "January, 1680/1," *Newton Correspondence*, 2:331.

[4] Newton to Burnet, "January, 1680/1," *Newton Correspondence*, 2:333.

[5] Newton writes that: "... to say something by way of conjecture, one may suppose that all ye Planets about our Sun were created together, there being in no history any mention of new ones appearing or old ones ceasing. That they all & ye sun too had at first one common Chaos. That this Chaos by ye spirit of God moving upon it became separated into several parcels and each parcel for a planet. That at ye same time ye matter of ye sun also separated from ye rest & upon ye separation began to shine before it was formed into that compact & well defined body we now see it. And the preceding darkness & light now cast upon ye Chaos of every Planet from ye Solar Chaos was the evening & morning wch Moses calls ye first day even before ye earth had any diurnall motion or was formed into a globular body. That it being Moses design to describe the origination of this earth only & to touch upon other things only so far as they related to it, he passes over the division of ye general chaos into particular ones & does not so much as describe ye fountain of that light God made that is ye Chaos of ye Sun, but only with respect to the Chaos of our Earth tells us that God made light upon ye face of ye deep where darkness was before. Further one might suppose that after our Chaos was separated from ye rest, by the same principle wch promoted its separation (wch might be gravitation towards a center) it shrunk closer together & at length a great part of it condensing subsided in ye form of a muddy water or limus to compose this terraqueous globe." Newton to Burnet, "January, 1680/1," *Newton Correspondence*, 2:332.

into the three regions of the waters of "the deep," dry land, and the "air or firmament."[6]

Finally, however, Newton adds—and here is the crucial point regarding miracles—that even though he might "suppose ye earth put in motion by an eaven [sic] force applied to it," he must still admit that he knows of :

> . . . no sufficient naturall [sic] cause of the earth [sic] diurnal motion. Where natural causes are at hand God uses them as instruments in his works, but I doe not think them alone sufficient for ye creation & therefore may be allowed to suppose that amongst other things God gave the earth it's motion by such degrees & at such times as was most suitable to ye creatures.[7]

Other possible instances of divine 'violations' of divinely created law of nature, for Newton, which presumably are very difficult to interpret naturalistically are the prophetic predictions about how the "Children of the resurrection" will occasionally be teleported about the galaxy in the company of the Holy Spirit during the millennial reign of Christ[8] and the equally hard-to-explain (on any rational, scientific ground) prophetic prediction that God will raise the dead, i.e., the "children of the dust," from their graves on judgment day.[9]

Newton's belief in miracles extends beyond those literally described in the Bible. He writes to Locke in February 1691/2 that "Miracles of good credit continued in the Church for about two or three hundred years" after the crucifixion.[10] In May, he writes to Locke once again to give an example of such a miracle "of good credit":

> Concerning miracles there is a notable passage or two in Irenaeus 1. 22, c. 56, recited by Eusebius, 1. 5. c. 17. The miraculous refection of ye Roman army by rain, at ye prayers of a Christian Legion (thence called fulminatrix) is mentioned by Ziphiline . . . & by Tertullian . . . , and by Eusebius . . . , & acknowledged by ye Emperor Marcus in a letter as Tertullian mentions.[11]

[6] Concerning the timing of the events literally described for each successive day, Newton writes that: ". . . by what is said above you may make ye first day as long as you please, & ye second day too if there was no diurnal motion till there was a terraqueous globe, that is till towards ye end of that days work." Newton to Burnet, "January, 1680/1," *Newton Correspondence*, 2:332–3.

[7] Newton to Burnet, "January, 1680/1," *Newton Correspondence*, 2:334.

[8] James E. Force, "'Children of the Resurrection' and 'Children of the Dust': Confronting Mortality and Immortality with Newton and Hume" in "*Everything Connects": In Conference with Richard H. Popkin. Essays in his Honor*, ed. James E. Force and David Katz (Leiden: E. J. Brill, 1998.)

[9] James E. Force, "The God of Abraham and Isaac (Newton)," in *The Books of Nature and Scripture: Recent Essays on Natural Philosophy, Theology, and Biblical Criticism in the Netherlands of Spinoza's Time and the British Isles of Newton's Time*, ed. James E. Force and Richard H. Popkin (Dordrecht: Martinus Nijhoff, 1994), pp. 179–200.

[10] Newton to Locke, 16 February, 1691/2, in *Newton Correspondence*, 3:195.

[11] Newton to Locke, 3 May, 1692, *Newton Correspondence,* 3:214–5.

William Whiston Talks About the Literal Occurrence of Miracles

William Whiston, too, is firm in his literal faith in scriptural stories of miracles. Whiston points out that even though Jeremiah, who "endured the severest Imprisonment for his Faithfulness to his Duty as a Prophet," was often "shock'd and surpriz'd at the same seemingly unequal and Partial Conduct of Providence," never made his "Difficulties or Complaints" the basis for:

> doubt or dispute about the Certainty of their Mission or Inspiration; but the Truth of the Promises and Threatnings they denounced from God; or about the Reality of Miracles that were performed in his Name.[12]

Whiston, who vociferously defended his own anti-trinitarianism, at first, defended what he regarded as the intemperate excesses of Thomas Woolston, a young clergyman "of very good reputation, a scholar, and well esteem'd . . . preacher, charitable to the poor, and beloved by all good men that knew him" who unfortunately adopted a mistaken approach to understanding scripture. However, when Woolston pursued his allegorical method to its inevitable conclusion and finally declared "that *Jesus Christ's* own miracles were no other than allegorical miracles, and not real facts," he became, in essence, a deist and Whiston severed all ties with him.[13]

[12] William Whiston, *Astronomical Principles of Religion, Natural and Reveal'd* (London, 1717), p. 292. Cf. *Astronomical Principles*, p. 260, where Whiston argues that: ". . . Neither the Mosaical Law, nor the Christian Religion, could possibly have been receiv'd and established without such Miracles as the Sacred History contains" and that ". . . The Miracles whereon the *Jewish* and *Christian* Religion are founded, were of old owned to be true by their very Enemies."

[13] William Whiston, in his *Memoirs of the Life and Writings of Mr. William Whiston*, 2 vols. (London, 1753), 1:199–200, begins his sad tale of Woolston's travails by explaining how Woolston, "poring hard upon" the "allegorical works" of Origen, came to doubt the literal truth of scripture and to prefer an allegorical hermeneutical approach. Whiston says that Woolston's preaching subsequently became "fanciful," "wild" and "disorder'd." When Woolston at last was expelled from his fellowship in Sidney Sussex College, Whiston "did all [he] could to save it for him, by writing the college on his behalf." Shortly thereafter the government prosecuted Woolston for "blasphemy and profaneness" and Whiston "went to Sir *Philip York*, the then attorney-general, but now lord chancellor, and gave him an account of poor Mr. *Woolston*, and how he came into his allegorical notions . . . desiring they would not proceed further against him." For whatever reason, these legal proceedings were dropped. But when Woolston published a pamphlet "against our Saviour's miracles" and was again indicted for blasphemy, Whiston told Woolston that: "tho' I pitied his case, and looked upon it as partly a disorder of mind, I did not think it became me to be farther concerned for him in any publick manner, tho' he had dedicated a pamphlet to me, and came himself to me. I told him, that had not my reputation, as a firm believer in the christian religion, been very good, he had done me great harm by his dedication. I farther told him, that what he now asserted seemed to me nearer to the sin against the Holy Ghost, than what had ever been asserted by any since the first times of the gospel. I withall asked him, why he did not assert that our Saviour was no more than an *allegorical person*, since then he might naturally work *allegorical miracles?* He replyed no: There was such a person as *Jesus Christ*." Whiston unabashedly dates the rise of deism to Woolston's attitude which asserts the miracles of Jesus to be mere allegorical fables. See James E. Force, "Newton's 'Sleeping Argument'," in *Standing on the Shoulders of Giants. A Longer View of Newton and Halley*, ed. Norman J. W. Thrower (Berkeley and Los Angeles: University of California, Press, 1990), p. 122, n.38.

Concerning God's providential creation of the "Natures, Conditions, Rules and Quantities, of those several Motions and Powers according to which all Bodies . . . are specifi'd, distinguished, and fitted for their several uses," Whiston is adamant that they, as well as the miracles of Jesus, "were no otherwise determin'd than by the immediate *Fiat*, Command, Power, and Efficiency of Almighty God."[14]

Samuel Clarke Talks About the Literal Occurrence of Miracles and Equates All Those Who Do Not Accept Such Miracles with Atheists

Samuel Clarke accepts scriptural accounts of miracles and refutes the deists of his day for whom the Christian revelation is neither necessary nor sufficient to obtain knowledge of God's attributes. Among the various kinds of deists whom Clarke categorizes and then attacks in his Boyle Lectures of 1705 are those who believe in both a Supreme Being and also in the attribute of divine providence but who confine the operation of God's providential power to the realm of "every *natural* thing that is done in the world." Such a form of deism, Clarke argues, must terminate in "*downright Atheism*" because the "*Practice and Behaviour*" of such deists "is exactly agreeable to that of the most openly professed *Atheists*."[15]

All of these Newtonians—Whiston, Newton, and Clarke—despite their general wariness about most miracle stories in scripture, and despite their almost eager willingness to sacralize the daily operations of natural law, do also appear, occasionally, to assert that there are real interventions of specially provident divine will into the created natural order. The tension which is seen to arise within their thought at this precise point has given rise to two modern schools of interpretation.

Newtonian Miracle Talk, Part II: Reconciling Newtonian Miracle Talk with Natural Law—The Grand Newtonian Attempt to Synthesize God´s General and Special Providence

Sir Isaac Newton and his followers adopt the idea that there is *both* a mechanical frame of nature obedient to the laws of nature, which is established by God's general providence at the time of creation, *and* a still active, specially provident God whose power is sufficient to come back into that created natural

[14] Whiston, *A New Theory of the Earth*, 2nd ed. (London, 1708), p. 225.

[15] Samuel Clarke, *A Discourse Concerning the Unchangeable Obligations of Natural Religion, and the Truth and Certainty of the Christian Revelation. Being Eight Sermons Preach'd at the Cathedral-Church of St. Paul, in the Year 1705, at the Lecture Founded by the Honourable Robert Boyle, Esq.* (London, 1706), pp. 26–8.

mechanism and to alter it at will. But there is often seen to be a tension between the two sorts of divine providence and the idea of nature which each seems to imply. The more detailed and defined the picture of the lawful, generally provident, natural, mechanical order becomes, the less room there appears to be for specially provident divine interventions which 'violate' natural law.

This apparent tension finds expression in the Newtonians' desire to be most wary when deciding whether to believe in reports of miracles, especially recent ones. Miracles may have indeed happened once long ago; they may possibly happen again. But they do not happen often. As John Wilkins had put this point, it is simply "not reasonable to think that the universal laws of nature, by which things are to be guided in their natural course, should frequently or upon every little occasion be violated or disordered."[16]

Moreover, in the Newtonian attempt to blend both general and special providence, there is, in addition to this critical wariness, also a tendency to use the term miracle to refer to God's continuous act of preserving the natural world as the main (the only?) instance of special providence. God's providential dominion is not limited to that of a purely creative deity active once long ago and since quiescent. God has actively continued to maintain his created order in being.

William Whiston´s Attempt at Synthesis

Whiston agrees with Newton that Moses uses non-technical language to accommodate "his words to the gross conceptions of the vulgar,"[17] and, therefore, never intends to give a 'philosophical' explanation in terms of

[16] John Wilkins, *Of the Principles and Duties of Natural Religion* (London, 1693), p. 130. Thomas Sprat, too, counsels extreme caution regarding modern reports of specially provident divine intervention, although he does not absolutely exclude the possibility that they may be true. See Sprat, *A History of the Royal Society* (London, 1667), pp. 359–60. Boyle, too, worries about the enthusiasm to overemphasize the mechanism of divine special providence. Though he insists that miracles do happen, we must not confuse our ignorance of some mechanical operations established by God's general providence with such prodigies. See Boyle, *A Free Inquiry into the Vulgarly Received Notion of Nature,* in *The Works of the Honourable Robert Boyle*, 6 vols., ed. Thomas Birch (London, 1772), 4:339a.

[17] See Newton's correspondence on this point with Thomas Burnet in *Newton Correspondence*, 2:331. Whiston's entire *New Theory of the Earth*, 2nd ed. (London, 1708), is prefaced with "A Large Introductory Discourse Concerning the Nature, Stile, and Extent of the Mosaick History of Creation." Whiston elaborates that "The Mosaick Creation is not a Nice and Philosophical account of the Origin of All Things; but an Historical and True Representation of the formation of our single Earth out of a confus'd Chaos, and of the successive and visible changes thereof each day, till it became the habitation of mankind" (p. 3.) For Whiston, and, to judge from Newton's earlier correspondence with Burnet in which the same interpretative position is adopted, for Newton, the account of the secondary mechanisms of nature which lie behind Moses' adaptation of the creation story for the "vulgar" Hebrews does not constitute an adequate "Philosophical account of the Origin of All Things." Whiston's book is intended to provide such an account. The chief natural mechanism which Whiston utilizes to explain "the formation of our single Earth out of a confus'd Chaos" is a comet. Comets of course are created by God in an initial act of general providence. Since then, these natural mechanisms have functioned naturally and in their continuous natural operation is reflected

mechanical causes. Most famously, he explains how a comet, passing in close proximity to the Earth "in the Seventeenth Century from the Creation," offers a highly probable, mechanical explanation of the "Deluge of Waters upon the Earth."[18]

In providing such a "philosophical" explanations for such an apparent break in the laws of nature as the evacuation of the flood waters, John Keill attacks Whiston's mechanistic explanation that the flood water simply flowed into the subterranean caverns deep beneath the earth through the fissures in the newly cracked crust. Keill calculates the amount of water necessary to flood the earth and works out that such a process would require1786.4 years—far too long. Keill and concludes that:

> . . . altho' Mr. Whiston has been pleas'd to ridicule my fondness for Miracles, yet since all the natural causes he has assign'd are so vastly disproportionate to the effects produc'd, he may at last perhaps be convinc's that the easiet, safest and indeed only way is to ascribe 'em to Miracles."[19]

But this intra-squad scrimmage between the Newtonians, Whiston and Keill, is finally about which phenomena described for the 'vulgar' in scripture are to be interpreted mechanically and which phenomena require a genuine interposition of divine power to violate the laws of nature so as to produce, literally, the effect described in scripture. Neither appear to doubt the Lord God's specially provident power to break or suspend natural law. Even Whiston wants to make room for real miracles in the traditional sense, i.e., as a violation of natural law, and so he accepts the possibility of specially provident intercessions in natural law.[20] When a natural, i.e., a "nice and philosophical account" is not possible, as in the case of reliably reported stories such as that of Whiston's contemporary, John Duncalf, or in properly interpreted scriptural accounts of the miracles of Jesus, Whiston accepts these accounts as real instances of the "necessity of, introducing the particular and immediate efficacy of the Spirit of God at first, as well as his continual concurrence

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one sort of Newton's idea about the continued providential care of God for his creation. See James E. Force, *William Whiston. Honest Newtonian* (Cambridge: Cambridge University Press, 1985), pp. 32–62.

[18] Ibid., pp. 300–1.

[19] Cited in James E. Force, *William Whiston*, p. 61.

[20] While Whiston prefers mechanical explanations of, especially, the events depicted by Moses concerning the creation of the earth, he also believes in some scripture reports of miracles, especially in those described in relation to Jesus and to the Apostles. God continued to interpose his will into the natural order on behalf of the members of the early Christian community, according to Whiston, right up to the moment in the fourth century when the Church becomes actively anti-Christian through the adoption of the idolatrous Athanasian creed. See *Mr. Whiston's Account of the Exact Time When Miraculous Gifts Ceas'd in the Church* (London, 1728), p. 7. Whiston, like John Wilkins, remains highly suspicious of reports of modern-day miracles. Even so, he recounts the story of one John Duncalf who stole a Bible and lied about it swearing that if he were the culprit let God "rot off" his hands. Unfortunately for Duncalf, this happened. Whiston urges that the exact narrative of this event "ought, in this sceptical age, to be reprinted, and recommended to all, who either deny, or doubt of the interposition of a particular divine providence . . . ." See Whiston, *Memoirs of the Life and Writings of Mr. William Whiston*, 1:6 and 2:443.

and conservation ever since . . . ."[21] In his usual mode, Whiston seeks the middle ground between a too ready reliance upon special providence and a total exclusion of even the possibility of such acts.

Samuel Clarke´s Attempt at Synthesis

Samuel Clarke (a close friend of Whiston and another Newtonian who engages in controversies on behalf of Newton) makes it clear in his correspondence with Leibniz that one of the chief points of disagreement between Leibniz and the Newtonians is the Newtonian insistence upon God's ability (and power) to intervene directly into the created world through interpositions of his specially provident will to alter natural law. It is precisely because the Newtonians insist that God can and does providentially direct and govern his creation as the Lord God of total dominion, even to the point of direct intervention in, and contravention of, the operation of natural law, that Leibniz levels against them the charge of reducing God to an inferior clock repairman. "According to this Newtonian doctrine," scoffs Leibniz, "God Almighty wants to *wind up* his watch from time to time: otherwise it would cease to move. He had not, it seems, sufficient foresight to make it a perpetual motion."[22]

Clarke replies that Leibniz misunderstands the nature of providence due to his doctrine of pre-established harmony which leaves God without any sort of continuing providential dominion following his initial act of generally provident creation. It corresponds more closely with the true nature of God's dominion, and redounds to his greater glory, that God fabricates the universe to be under his continuous, specially provident governance. Clarke argues that, for the Newtonians:

> the wisdome of God consists in framing originally the perfect and complete idea of a work, which begun and continues, according to that original perfect idea, by the continual uninterrupted exercise of his power and government.[23]

Clarke is not so unequivocal as Whiston about the nature of the phenomenon of gravity as a manifestation of God's continual uninterrupted exercise of his specially provident dominion over nature. When Leibniz ridicules the

[21] Whiston, *A New Theory of the Earth*, p. 226.

[22] "Mr. Leibnitz's First Paper," in *The Leibniz-Clarke Correspondence*, ed. H. G. Alexander (New York: Philosophical Library, 1956), p. 11. See also *Leibniz Selections*, ed. Philip P. Wiener (New York: Scribners, 1951), p. 216. Henning Graf Reventlow has also described this attempt by Newton and Clarke to synthesize general providence and special providence in order to retain a "personal God" and to guard against a "consistent rationalism." For Reventlow, "This is probably the most important issue in Clarke's correspondence against Leibniz." See Henning Graf Reventlow, *The Authority of the Bible and the Rise of the Modern World*, trans. John Bowden (Philadelphia: Fortress Press, 1985), p. 340.

[23] "Dr. Clarke's Second Reply," in *The Leibniz-Clarke Correspondence*, p. 22.

Newtonian conception that the everyday operation of gravity is itself an instance of a specially provident miracle,[24] Clarke replies with the usual Newtonian assertion that a miracle is only what is unusual in nature and so, because the operation of gravity is regular and constant, "'tis no miracle, whether it be effected immediately by God Himself, or mediately by any created power."[25] At other times, Clarke echoes Whiston. In Clarke's Boyle Lectures, he states of gravity that it results from a cause "superior to matter *continually* exerting on it a certain force or power" and thus that the world depends "every moment on some superior being, for the preservation of its frame."[26]

Clarke seems ultimately to sacralize nature in the Augustinian fashion and, with the identity between nature-and-miracles established, to rule out real 'violations' in natural law. In his Boyle Lectures for 1705, Clarke writes that a miracle:

> is a work effected in a manner unusual or different from the common and regular method of Providence by the interposition either of God Himself, or some intelligent agent superior to man, in the proof or evidence of some particular doctrine or in attestation to the authority of some particular person. And if a miracle so worked be not opposed by some plainly superior power nor be brought to attest to a doctrine either contradictory in itself or vicious in its consequences—a doctrine of which kind no miracles in the world can be sufficient to prove—then the doctrine so attested must necessarily be looked upon as Divine, and the worker of the miracle entertained as having infallibly a commission of God.[27]

Isaac Newton's Attempt at Synthesis

Most of the miracle stories about the Creation, for Whiston and Clarke, then, have natural interpretations and, if properly interpreted, merely show *natura naturans*. They echo their master on this point. In an important variant of his manuscript entitled "Paradoxical Questions concerning y^{e} morals & actions of Athanasius and his followers" there emerges most clearly Newton's view that, among Athanasius' many other apostasies, he and his followers feigned miracles through the "magical use of the signe of y^{e} Crosse" in order to attract a following:

[24] "Mr. Leibnitz's Third Paper," in *The Leibniz-Clarke Correspondence*, pp. 29–30; "Mr. Leibnitz's Fourth Paper," Ibid., pp. 42–3; "Mr. Leibnitz's Fifth Paper," Ibid., pp. 91–5. Cf. *Leibniz Selections*, pp. 227–8, 235, and 275–8.

[25] "Dr. Clarke's Third Reply," in *The Leibniz-Clarke Correspondence*, p. 35.

[26] Clarke, *Works*, 2:601. Cited by H. G. Alexander in his Introduction to *The Leibniz-Clarke Correspondence.*

[27] Clarke, *A Discourse Concerning the Unchangeable Obligations of Natural Religion, and the Truth and Certainty of the Christian Revelation, Being Eight Sermons Preached at the Cathedral Church of St. Paul in the Year 1705,* in *A Defence of Natural and Revealed Religion*, 3 vols, ed. Sampson Letsome and John Nicholl (London, 1739), 2:165.

> These & such like stories sufficiently open the designe of Athanasius & his party in setting on foot this humour of pretending to miracles. They found by experience y^t^ their opinions were not to be propagated by disputing & arguing, & therefore gave out that their adversaries were crafty people and cunning disputants and their own party simple well meaning men, and there imposed this law upon the Monks that they should not dispute about y^e^ success of their cause to y^e^ working of miracles and spreading of monkery.[28]

Newton exhibits a similar wariness of scriptural miracle stories and famously states that miracles "are not so called because they are the works of God but because they happen seldom and for that reason excite wonder."[29]

For Newton, the historical creation of gravity demonstrates God's general providence but its continuous operation since that point reveals His special providence. God's sustained preservation of the order of nature and natural laws since the creation demonstrates divine special providence because of the very nature of gravitational attraction. Newton *claims* that "a continual miracle is needed to prevent the Sun and fixed stars from rushing together through gravity."[30]

This point is echoed by such important Newtonian disciples as Samuel Clarke and William Whiston who is especially vocal in adopting Newton's stance and asserts that the very fact of nature's continuous operations in accord with natural law proves specially provident divine dominion:

> 'Tis now evident, that *Gravity*, the most mechanical affection of Bodies, and which seems most natural, depends entirely on the constant and efficacious, and, if you will, the supernatural and miraculous Influence of Almighty God.[31]

[28] Newton, "Paradoxical Questions concerning ye morals & actions of Athanasius & his followers," under the question: "Whether Athanasius did not start false miracles for his own interest" (William Andrews Clark Memorial Library, University of California, Los Angeles). Cf. Newton to John Locke, 16 February 1692, in *Newton Correspondence*, 3:195.

[29] Cited in Herbert McLachlan, ed., *Newton's Theological Manuscripts* (Liverpool: Liverpool University Press, 1950), p. 17. Newton's wariness is an echo of the opinion of Thomas Sprat who, in his *History of the Royal Society*, is quick to emphasize the contributions of the Society's first members in demonstrating God's general providence by means of the design argument. (See Thomas Sprat, *History of the Royal Society*, p. 349.) However, Sprat is also quick to point out that in no way does the new natural philosophy of the Society militate against belief in God's acts of miraculous special providence as commonly understood, i.e., as "violations" of natural law. On the contrary, an "Experimental Philosopher" of the Society who "familiarly beholds the inward workings of things" will strengthen belief in God's true miracles by exposing fraudulent, enthusiastic, "Holy Cheats": "Let us then imagin our *Philosopher* to have all slowness of belief, and rigor of Trial, which by some is miscall'd a blindness of mind, and hardness of heart. Let us suppose that he is most unwilling to grant that any thing exceeds the force of Nature, but where a full evidence convinces him. Let it be allow'd, that he is always alarm'd, and ready on his guard, at the noise of any *Miraculous Event*; lest his judgment should be surprized by the disguises of *Faith*. But does he by this diminish the Authority of *Antient Miracles*? or does he not rather confirm them the more, by confirming their number, and taking care that every falsehood should not mingle with them?" Sprat, *History of the Royal Society*, p. 360. All this comes in a section entitled "Experiments will not destroy the Doctrine of Prophecies, and Prodigies." Sprat, *History of the Royal Society*.

[30] *Newton Correspondence*, 3:336. David Gregory in a "Memoranda," is the source of this Newtonian "claim."

[31] William Whiston, *A New Theory of the Earth*, p. 284.

When Newton and Whiston declare that the daily operation of gravity is a miraculous effect of God, they mean that, in obeying natural laws, physical objects continually exhibit signs of God's special providence. But if all instances of obedience to the laws of nature are miraculous in this sense, then the traditional sense of miracles as a special denial or negation or, to use Hume's term, "violation," of the laws of nature is set aside. Obeying the laws of nature becomes, if this view is taken to be the exclusive meaning and range of God's special providence, specially provident and the commonest natural event is itself a miracle. As Whiston says:

> I do not know whether the falling of a Stone to Earth ought not more truly to be esteem'd a supernatural Effect, or a Miracle, than what we with the greatest surprize should so stile, its remaining pendulous in the Open Air; since the former requires an *active Influence* in the first Cause, while the latter supposes *non-Annihilation* only.[32]

Newton and such Newtonian disciples as Whiston certainly do hold that most miraclous events are not a "violation" of natural law. Rather, the sustained operation of natural law itself is termed a miracle and illustrates God's providential dominion. Newton observes, and Whiston echoes, that miracles in the traditional sense are often simply misunderstandings on the part of the vulgar. Miracles, writes Newton in his most widely known quote on this topic, "are not so called because they are the works of God, but because they happen seldom and for that reason excite wonder."[33]

Nevertheless, the Newtonians often talk as if they believe, at least sometimes, in the occurrence of event which contravene or "violate" nature and which are caused by God's direct will, i.e., in miracles in the ordinary sense.

Modern Interpretations of Newtonian Miracle Talk: Two Current Schools of Interpretation Which Attempt to Explain the Newtonian Conception of ``Miracle´´ Embedded in Newtonian Miracle Talk

Given the centrality of Newton's Lord God to his reading of both the "book" of nature—especially its literal description of the manner in which God established his generally provident laws of nature 'in the beginning'—and the "book" of scripture—with all of its tales of specially provident interventions in nature through "miracles" which seemingly **violate** natural law—a controversy has arisen regarding the precise nature of the Newtonian view of miracles. We have, in the most current literature, a tough choice to make

[32] Ibid.
[33] *Newton's Theological Manuscripts*, p. 17.

regarding how Newton, and such important Newtonian theorists as Whiston, and Clarke, viewed miracles between the *Modernist-Paradox School* and the *Medievalist-Rational* School.

The Modernist-Paradox School

Operating with a modernist, Humean conception of a miracle as a "violation" or break or miraculous suspension of a "law" of nature, interpreters in this category argue that Newton and the Newtonians are unselfconscious deists who—without realizing it—internalize the logical tension between (1) a Lord God who, in the past, has directly interposed his specially provident power to contravene the natural order through miraculous breaks or suspensions of that order (and who remains fully capable of such miraculous contraventions of natural law in the future) and (2) the rigid natural laws inherent within that natural order which are called LAWS because they operate universally without exception. The most prominent interpreter in this *Modernist-Paradox School*, Richard S. Westfall, emphasizes the paradox he claims to find at the heart of Newton's view of miracles: "In short, Newton both believed in and did not believe in miracles."[34]

For Westfall, Newton simultaneously holds two internally contradictory positions: there is a "mechanical idea of nature" according to which nature always obeys universal laws established by God "in the beginning" and there is, simultaneously, a still active, supreme Lord God who is powerful enough to "violate" the universal laws of nature by effecting specially provident miracles. In holding fast to these two concepts simultaneously, Newton's thought contains, "*in embryo*," the seeds of its own dissolution and of the triumph in the modern world of a secularized science dominant over a supernatural Christianity. The effect of Westfall's analysis is to shift the "warfare" between science and religion away from the standard nineteenth-century theory—according to which heroic modern scientists battle to the death with repressive priests—and toward an internalized, unconscious warfare within the individual psyche. Westfall argues that, while the "natural piety" of the many members of the Royal Society is quite genuine, still:

> the skepticism of the Enlightenment was already present *in embryo* among them. To be sure, their piety kept it in check, but they were unable fully to banish it. What else can explain the countless dissertations on natural religion, each proving that the fundamentals of Christianity are rationally sound? They wrote to refute the atheism within their own minds.[35]

[34] Westfall, *Science and Religion in Seventeenth-Century England* (Ann Arbor: The University of Michigan Press, 1973), p. 204.
[35] Ibid., p. 219.

Regarding Newton specifically, Westfall never deviates from his first view, namely that:

> Newton both believed in and did not believe in miracles. As a Christian he accepted them, and he did not openly attack them in any context. On the other hand, as a scientist he introduced qualifications which amounted to repudiations. He could not really tolerate the thought that God might upset the laws of nature which He had created. Although logic seemed to require the rejection of miracles, he could not bring himself finally to cast out a belief which he considered vital to Christianity; and he tried to save himself by hiding behind a façade of words . . . [and] abandoned himself to ambiguities and inconsistencies, which gave the appearance of divine participation in nature, but not the substance.[36]

The Medievalist-Rational School

Operating within a medievalist, Augustinian view of miracles as simply rare or unusual phenomena whose natural causes are, as yet, unknown, interpreters in this school emphasize the rationality of miracles through the sacralization of *all* natural phenomena.[37] Such unusual events, apparently unfathomable from the perspective of a human observer, are not at all paradoxical to God or willful "violations" of his providential natural law. On this view, Newton and the Newtonians ruthlessly rationalize scriptural stories about miraculous breaks or suspensions in the lawful ordering of nature reducing them to mere fables for the vulgar.

One recent interpreter in this tradition of viewing Newton's understanding of miracles in this natural light is rightfully uneasy about Westfall's view that Newton and his contemporaries somehow lived "strange dichotomous mental lives . . . ." According to this view, the "problem" is one of semantics: "the Newtonians rejected that standard definition of miracle, according to which

[36] Ibid., p. 204.

[37] Betty Jo Dobbs is the first interpreter to draw a parallel between St. Augustine's position on miracles and that of Newton and to argue that Newton attempts to balance miracle and natural law, special and general providence, by subsuming special providence under general providence. She wrote that St. Augustine's view was that: "ultimately there was only one miracle, creation itself, and that within that original creation God had implanted 'seminal reasons' that held all the possibilities for the future. Like the spermatic *logoi* of the Stoics, Augustine's seminal reasons were hidden within the natural world; when unusual events occurred that seemed miraculous to human beings, those events were really only the working out of the hidden natural causes and were never *contra naturam*, against nature. All events were both "natural" and "miraculous" in this sacramental view of the whole order of creation. The events that happen regularly are "daily miracles" but people become accustomed to them, no longer giving them reverence as manifestations of God's power, so God also allows for unusual events to be drawn from the *seminales rationes* that provoke wonder, amazement, and awe at the mysterious creative power of God. As did Newton, Augustine thought that both natural law and "Miracles . . . so called" are the works of God." Dobbs, *The Janus Faces of Genius. The Role of Alchemy in Newton's Thought* (Cambridge: Cambridge University Press, 1991), p. 231.

a miracle must involve a violation of laws of nature."[38] On this view, "the Newtonians and a number of their fellow travelers"[39] use the term "miracle" to point to a natural event accomplished through natural, secondary causes. A miracle, by definition, is NOT a Humean "violation" of ordinary natural law caused by the direct interposition of specially provident divine will; instead "miracle" is a term for a perfectly natural event whose natural, secondary causes are not as yet understood by scientific reason. On this view, Newton must once again be interpreted as at least a proto-deist for whom scriptural stories of miracles are mere fables for the vulgar. Newton is, on this view, no longer an unselfconscious deist as Westfall argues. Rather, Newton becomes a truly "hard" deist who is self-consciously aware of the tension between natural law and Humean miracles (which Westfall maintains is unnoticed by Newton) and 'reconciles' this tension by sacralizing the whole of nature thereby rendering incoherent any supernatural "violation" of natural law. Interpreters in this school emphasize what Westfall had also pointed out, i.e., that, for such Newtonians as Whiston and, especially, Clarke:

> *many* miracles, in particular those recorded in the Old Testament, were merely 'relative.' In one way or another the marvelous events set down by Moses in the Pentateuch could be demonstrated to fall within the mechanistic order of nature.[40]

On this view, while the Newtonians insisted that in principle no event could be a true Humean miracle, i.e., a "violation" or break or suspension of natural law, they could concede that certain rare and remarkable events such as the miracle of creation "still evaded scientific explanation."[41] Newton, Whiston, and Clarke do not "live strange dichotomous mental lives." Rather, as modern scientists whose position in society depends upon maintaining the outward appearance of orthodoxy, they hold that "events traditionally labeled 'miracles' had taken place" but they deny "that any philosophical sense could be made of the claim that they were breaches of natural law."[42] Finally, as with any deist who dismisses biblical miracles as mere fables for the vulgar, Newton did not and could not believe in miracles in the Humean sense. [43] Even the original imparting of diurnal motion to the earth, teleporting about the

[38] Peter Harrison, "Newtonian Science, Miracles, and the Laws of Nature," *Journal of the History of Ideas* 56, No. 4 (October, 1995), p. 532.
[39] Ibid., p. 539.
[40] Ibid., p. 539. I have emphasized the term "many."
[41] Ibid., p. 548.
[42] Ibid., p. 552.
[43] Ibid., p. 553. Harrison never says that Newton is a deist. He says that Newton, like St. Augustine, sacralizes the whole of nature. After the initial creation, everything that happens is BOTH natural AND miraculous because, at the creation, God implanted "seminal reasons" (equivalent to the spermatic *logoi* of the Stoics) which remained concealed within the natural order until the divinely pre-ordained time for their realization. Such events can never be against nature because they are programmed into nature at the creation by God and unfold in accordance with this initial divinely implanted programming very like Leibnizian monads. Again, on this view the entire natural order is sacralized as simultaneously natural and

stars in the company of the Holy Ghost, and raising—and re-embodying—the "children of the dust" to meet their maker need not necessarily be Humean "violations" of natural law. While the causes of such extraordinary events may not be understood NOW, with time their inner springs and mechanistic principles might be fully revealed.

Newton's *Pantokrator*

How Powerful Is Newton's *Pantokrator*? Can He Intervene Directly In Nature and, If So, Can He Simultaneously Contravene, or "Violate," Natural Law?

The proponents of the *Medievalist-Rational* School have most helpfully shown us that the proper questions which we need to ask about the Newtonian notion of miracles are (1) whether—even if we take it as a given that Newton's *Pantokrator* has not intervened directly in nature perhaps since the creation—he can ever act in the future so as to interpose his will back into his created order and (2) whether—if and when he does act to interpose his will directly back into nature in some possible future—he can cause an event which 'violates' the natural laws which He established at the original creation? Though the Newtonians talk readily enough about the literal occurrence of miracles, they might, as we have seen, mean only that they believe in the sort of event programmed by God into the generally provident natural creation whose natural explanation is merely not, as yet, understood by human reason but which is programmed into the natural order (which is preserved by God's sustaining will.) All the Newtonian talk about the literal occurrence of miracles might be, on this *Medievalist-Rational* interpretation, merely talk about miraculous-natural (or natural-miraculous) events whose natural element is not yet comprehended. The two large questions remain, then, of whether God can intervene in nature and, if he should choose to do so, can he also "violate" his natural laws?

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miraculous and, again, see Dobbs, *The Janus Faces of Genius*, pp. 230–1. However, to both Harrison and Dobbs, I would point out that St. Augustine arrives at his interpretation as a philosopher who has learned from St. Ambrose that the Bible can and must be interpreted allegorically. The Bible becomes a collection of allegorical fables into which the saintly Platonist, following Ambrose, reads his own meaning. But Newton's "methodizing" of scriptural interpretation and Whiston's "third way" rejects this interpretative approach. In their day, only deists such as Charles Blount and Thomas Burnet, in the revealing phrase of John Leland, attempt simply "*to set aside revealed religion*" by reading it as akin to the irrational myths of Aesop. See John Leland, *A View of the Principal Deistical Writers that have Appeared in the Last and Present Century* (London, 1754), p. iii. In a revealing set of verses from the period, the character "Thomas Burnet" is made to recite the following verses:

> That *all* the books of Moses Were nothing but supposes.
> That as for Father Adam and Mrs. Eve, his Madame,
> And What the devil spoke, Sir,
> 'Twas nothing but a joke, Sir,
> And well-invented flam. [Cited in the DNB, s.v. Burnet, Thomas].

Newton and Whiston on the Lord God's Absolute Power to "Interpose" His Will into the Natural Order

In a manuscript dating from around 1672, Newton states that "*natures obvious laws*" are contingent upon the voluntary act of God's will. Newton writes that:

> The world might have been otherwise than it is (because there may be worlds otherwise framed than this). It was therefore no necessary but a voluntary and free determination that it should be thus. And such a voluntary [cause must be God]. Determination implies a God. If it be said the world could be no otherwise than it is because it is determin'd by an eternal series of causes, that's to pervert not to answer the first proposition. For I mean not that the world might have been otherwise notwithstanding the precedent series of causes, but that the whole series of causes might from eternity have been otherwise here, because they may be otherwise other places.[44]

If the Lord God's power is such that He could create completely different kinds of matter—with different kinds of properties—in "other places" in the universe, it seems to follow, at least to me, that He is not bound or necessitated in any way by the particular laws which he chose to effect in this remote corner of the Milky Way. This point is reinforced by Newton's criticism of Descartes's philosophy of nature. Descartes, according to Newton, identified matter with its essential primary quality, extension. Descartes consequently, and most dangerously in Newton's view, considered this essential extension to be eternal and immutable and thus naturally possessed of a sort of innate necessity, a position which led inexorably to atheism by intellectualizing matter and divorcing it from God's causal efficacy. Newton strongly challenges what he regards as the tendency to atheism implicit within Descartes's theory of matter and asserts against Descartes that matter is always an effect caused by God and that, for all poor old mankind may know, He can cause any sort of matter and any sort of laws to govern it. In his early (ca. 1668) manuscript entitled *De Gravitatione*, Newton had also asserted that matter:

> . . . does not exist necessarily but by the divine will, because it is hardly given to us to know the limits of divine power, that is to say whether matter could be

[44] *Of natures obvious laws & processes in vegetation*, Dibner MSS 1031 B (part), Dibner Library of the History of Science and Technology, Special Collections Branch, Smithsonian Institution Branch, Smithsonian Institution, Washington, D.C.: "The world might have been otherwise then it is (because there may be worlds otherwise framed then this) Twas therefore noe necessary but a voluntary & free determination y^t it should be thus. And such a voluntary [cause must be a God]. Determination implys a God. If it be said y^e w^{ld} could bee noe otherwise y^n tis determined by an eternall series of causes, y^{ts} to pervert not answer y^e I^{st} prop: ffor I meane not y^t y^e [symbol for the world] might have been otherwise $notw^{th}$ standing the precedent series of causes, but y^t y^e whole series of causes might from eterity [sic] have been otherwise <because they as well as, *deleted* > / because they may be otherwise *inserted* / in other places." Transcribed and printed by Dobbs, *The Janus Faces of Genius*, pp. 256–70. See p. 266. The transcription apparatus has been slightly modified.

> created in one way only, or whether there are several ways by which different beings similar to bodies could be produced.[45]

This world, and the "whole series of causes" in it, could have been different given the absolute power of the Lord God. Newton hammers home this theme in his *Opticks* toward the end of Query 31[46] where he repeats his view about the unlimited nature of the providential power of the Lord God:

> And since Space is divisible *in infinitum*, and Matter is not necessarily in all places, it may be also allow'd that God is able to create Particles of Matter of several Sizes and Figures, and in several Proportions to Space, and perhaps of different Densities and Forces, and thereby to vary the Laws of Nature, and make Worlds of several sorts in several Parts of the Universe. At least, I see nothing of Contradiction in all this.[47]

Because this world is so clearly contingent upon God's original creative will and because there is no necessity in nature which forces God to choose what to create and what not to create, who are we to claim that the Lord God who created nature and "*natures obvious laws*"—and who is so powerful that He could have created any other sort of nature which He chose—no longer possesses sufficient power to re-intervene directly in that order? If it is conceivably a part of God's power, and it clearly is for Newton, then it is possible. Newton sees "nothing of Contradiction" in such a conception of God's power.[48]

[45] Newton, *De Gravitatione et Aequipondio Fluidorum*, Cambridge MS Add. 4003. This text is found in *Unpublished Scientific Papers of Isaac Newton*, ed. by A. Rupert Hall and Marie Boas Hall (Cambridge: Cambridge University Press, 1962), p. 137. This text is cited by Margaret J. Osler, *Divine Will and the Mechanical Philosophy. Gassendi and Descartes on Contingency and Necessity in the Created World* (Cambridge: Cambridge University Press, 1994), p. 152, who kindly pointed it out to me with most of the other texts cited in this section.

[46] The first edition of the *Opticks* was published in London in 1704; it contained sixteen queries (Queries 1–16.) A second edition in Latin, the *Optice*, was published in 1706 with seven new queries (Quaestia 17–23.) Another eight queries were added to the second English edition in 1717. Quaestio 23 became, at that point, Query 31.

[47] Sir Isaac Newton, *Opticks or A Treatise of the Reflections, Refractions, Inflections & Colours of Light*, based on the fourth ed. London, 1730, with a Foreword by Albert Einstein, an Intro. By Sir Edmund Whittaker, a Preface by I. B. Cohen, and an Analytical Table of Contents prepared by Duane H. D. Roller (New York: Dover, 1952), pp. 403–4.

[48] Newton writes in his manuscript *Of natures obvious laws & processes in vegetation* "Of God" that: "What ever I can conceive wthout a contradition [sic], either is or may (effected *deleted*) / bee made / by something that is: I can conceive all my owne powers (knowledge, (*illegible word*, *deleted*) activating matter &c) wthout assigning them any limits Therefore such powers either are or may be made to bee." Transcribed by Dobbs, *The Janus Faces of Genius*, p. 166.

Samuel Clarke also publishes the Newtonian view that, because the concourse of the world depends entirely on God's will, that any "Alteration," including total "Annihilation," is possible to conceive without a contradiction. Clarke writes that: "For whether we consider the *Form* of the World, with the *Disposition* and *Motion* of its Parts; or whether we consider the *Matter* of it, as such, without respect to its present Form; every Thing in it, both the *whole* and every one of its *Parts*, their *Situation* and *Motion*, the *Form* and the *Matter*, are the most Arbitrary and Dependent Things, and the farthest removed from Necessity

The Newtonians were self-consciously aware of the conception of the Lord God of absolute power and total dominion even prior to the second edition with its explicit description of the Lord God in the General Scholium. A most interesting discussion occurred, in all probability, sometime between 1692 and 1696 when William Whiston queried Newton about why Newton did not draw from his philosophical "Principles" the great conclusion about the Lord God's power to interpose his will into the constitution of the world. Whiston, records that, he "early" asked Newton:

> . . . why he did not at first draw such Consequences from his Principles, as Dr. *Bentley* soon did in his excellent Sermons at Mr. *Boyle's Lectures*; and as I soon did in my *New Theory*; and more largely afterward in my *Astronomical Principles of Religion*; and as that Great Mathematician Mr. *Cotes* did in his excellent *Preface* to the later Editions of Sir. I. N.'s *Principia*: I mean for the advantage of Natural Religion, and the Interposition of the Divine Power and Providence in the Constitution of the World; His answer was, that He saw those Consequences; but thought it better to let his Readers draw them first of themselves: Which Consequences however, He did in great measure draw himself long afterwards in the later Editions of his *Principia*, in that admirable *General Scholium* at its conclusion; and elsewhere, in his *Opticks* . . . .[49]

In 1728, Whiston rectifies Newton's reticence by publishing *Sir Isaac Newton's Corollaries from his own Philosophy and Chronology; in His Own Words* in which Whiston quotes from Query 31, including that part which is cited above, goes on to quote at some length from the General Scholium (in Whiston's own English translation), delivers "Parallel Clauses out of Mr. *Cotes's* Preface to the Second Edition" of the *Principia*, and concludes with "Sir Isaac Newton's Corollaries from his Chronology . . . in his Own

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that can possibly be imagined." Samuel Clarke, *A Discourse concerning the Being and Attributes of God* (London, 1732), p. 23. Clarke is controverting, in this passage, Spinoza who claims that the world is necessarily existent. Cf. the remark by Cleanthes in David Hume, *Dialogues Concerning Natural Religion*, in Part IX. Cleanthes attempts to negate Demea's deployment of the cosmological-necessitarian argument by observing that: "Nothing is demonstrable unless the contrary implies a Contradiction. Nothing that is distinctly conceivable, implies a contradiction. Whatever we conceive as existent, we can also conceive as non-existent. There is no Being, therefore, whose non-existence implies a contradiction. Consequently there is no Being, whose existence is demonstrable. I propose this argument as entirely decisive, and am willing to rest the whole controversy upon it." Hume, *Dialogues Concerning Natural Religion*, ed. with an intro. by Norman Kemp Smith (Edinburgh: Thomas Nelson & Sons Ltd., 1947), p. 189.

[49] William Whiston, *A Collection of Authentick Records Belonging to the Old and New Testament*, 2 vols. (London, 1728), 2:1073–4. Cited in Force, *William Whiston*, p. 101, where the quote continues with Whiston's amusing observation that he cannot help but to quote another conversation with Newton at this point: "Nor can I dispence with myself to omit the Declaration of his [Newton's] Opinion to me, Of the Wicked Behaviour of most modern Courtiers, and the Cause of it, which he took to be their having *laughed themselves out of Religion*; or, to use my on usual Phrase to express both our Notions, because *they have not the fear of God before their Eyes*, Which Characters being, I doubt, full as applicable to our present Courtiers, as they were to those of whom he apply's them long ago, is a Cause of great Lamentation."

Words" regarding the one true "primitive" Religion of Noah and his sons prior to its idolatrous corruption "after the Days of *Melchizedek* . . . ."[50]

It is, then, for Newton and his Newtonian followers thoroughly possible for God to intervene in this created natural order even if he has not done so since the creation. There is nothing in Newton's conception of matter or natural law—no inherent, unlimited necessity, Cartesian or otherwise—which might impede God in the free exercise of his will. But if God can act so as to intervene in created nature, can He simultaneously act to contravene his natural laws. Could he, in short, effect a Humean "violation of the laws of nature"?

Newton's *Pantokrator* and Our Limited Ability To Know Contingent Nature: Newton's Scientific Method Reflects his Awe before the Power of the Free Exercise of the Lord God's Will

In his literal interpretation of prophecies which describe the future state of the messianic New Jerusalem, Newton writes that Christ rules over this dominion with the help of the "Children of the Resurrection" and the "mortal Jews on earth."[51] Newton then goes on to describe the interaction of the immortal "Children of the Resurrection" with the mortals who share their abode during the millennium.[52] In Newton's view, the "Children of the Resurrection" are spectral saints who may have the power to beam about the heavens in company with the Holy Ghost while ordinary "sleeping" souls await their day of judgment, asleep in the dust, until after the final triumph of Satan.

In the *Medievalist-Rational* view of miracles, the ultimate and absolute power which causes these extraordinary effects is not the exercise of any

[50] William Whiston, *Sir Isaac Newton's Corollaries from his own Philosophy and Chronology; in His Own Words* (London 1729) contains a three-page extract from the last paragraphs of Query 28 (Whiston, in his *Corollaries* identifies the "dense fluid" confuted in Query 28 as "Cartesian" in brackets); six pages from Query 31; two pages from Cotes's Preface to the second edition of the *Principia*; and two pages from Newton's *Chronology*.

[51] Yahuda MS 6, fol. 16r, at the Jewish National and University Library, Jerusalem: "We have hitherto considered the new Jerusalem as a City of mortals only: but whilst Christ is the chief corner stone of this city, whilst he rules the nations wth a rod of iron & gives power over them to the saints risen from y^{e} dead (Apoc. 2.26) & makes them Kings over the earth (ch. 1.6 and 5.10) & gives them to eat of the tree of life w^{ch} is in the midst of the Paradise of God & to enter in through y^{e} gates into y^{e} City (ch. 2.7 and 22.14) & writes upon the name of this new Jerusalem (ch. 3.12) this city must be understood to comprehend as well Christ & y^{e} children of the resurrection as the race of mortal Jews on earth."

[52] Yahuda MS 6, fol. 19r: ". . . we are not to conceive that Christ and the Children of the resurrection shall reign over the nations after y^{e} manner of mortal Kings or convers wth mortals as mortals do wth one another; but rather as Christ after his resurrection continued for some time on earth invisible to mortals unless upon certain occasions when he thought fit to appear to his disciples; so it is to be conceived that at his second coming he and the children of the resurrection shall reign invisibly unless they shall think fit upon any extraordinary occasions to appear. And as Christ after some stay in or neare the regions of this earth ascended into heaven so after the resurrection of the dead it may be in their power to leave this earth at pleasure and accompany him into any part of the heavens, that no region in the whole Univers may want its inhabitants."

supernatural, specially provident, direct interposition of divine will so as to contravene the ordinary mechanisms of nature. Such events are merely God operating in a non-self-contradictory fashion through his generally provident natural laws of cause-and-effect, the many particulars of which humankind may not yet grasp. Perhaps God, when he built the laws that regulate observable effects also built an as yet undiscovered mechanism—a kind of "Star Trek" teleportation device—which enables the "Children of the Resurrection" to beam about the universe. And, it is certainly the case, the Newtonians do go a long way to disavow many, if not all, reports of such scriptural reports of historical Humean miracles and search relentlessly for a natural cause sufficient to produce the observed effect. Whiston's second postulate in his "Large Introductory Discourse concerning the Genuine Nature, Stile, and Event of the *Mosaick* History of the Creation" in his *New Theory* is "That which is clearly accountable in a natural way, is not without reason to be ascrib'd to a Miraculous Power."[53]

But do the Newtonians disavow even the possibility that God might ever produce a genuine "violation" of the laws of nature in the future? Most of the events wrongly categorized as Humean miracles may in fact be caused, and explained, naturalistically but does that fact rule out the possible exercise of such miraculous interpositions of divine will in the future? In my view, the implications of Newton's conception of the *Pantokrator* for his scientific methodology strongly hint that the answer is that Newton builds into his scientific methodology the possibility for God to contravene his own laws in future miracles.

Newton's methodological procedure for obtaining knowledge of nature begins with "Analysis" (*resolutio*) and moves to "Synthesis" (*compositio.*)[54] For Newton, in contrast to Descartes who begins with *a priori* propositions which are clearly and distinctly conceived and therefore necessarily true, the initial path of Newtonian "Analysis" is identified with empirical experiments and observations. Experiments and observations which admit of "no exception" are "pronounced generally," i.e., accepted as provisionally true. On the basis of this empirical starting point, Newton inductively derives probationary "Principles" such as, for example, the Inverse Square Law. The second part of Newton's *probatio duplex* is the synthetic deduction of future phenomena on the basis of these probationary "Principles."[55]

[53] William Whiston "Large Introductory Discourse concerning the Genuine Nature, Stile, and Extent of the *Mosaick* History of the Creation," p.95, separately paginated, introductory essay in *A New Theory of the Earth*.

[54] Henry Guerlac, "Newton and the Method of Analysis," in *Essays and Papers in the History of Modern Science* (Baltimore: The Johns Hopkins University Press, 1977), pp. 193–216.

[55] Sir Isaac Newton, *Opticks*, pp. 404–5. An abbreviated version of this Query was published in the Latin edition of 1706 as Query 23. In the citation of Query 31 below, I have added the emphasis: "As in Mathematicks, so in Natural Philosophy, the Investigation of difficult Things by the Method of Analysis,

For Newton, such probationary "Principles" are "the best way of arguing which the Nature of Things admits of" but even the scientific knowledge which they provide is limited to the *current* "Nature of Things" which, in turn, is utterly dependent, both for its generally provident creation and its specially provident continued operation in its normal fashion, upon the absolute will and power of the Lord God of supreme dominion described in the General Scholium. Scientific knowledge, which is confined strictly to empirically discovered, and empirically verified, properties of bodies and to the probationary "Principles—or natural laws—derived from experimental verifications, depends on God leaving the natural order well enough alone.

Consider, now, the "Rules of Reasoning" published in Newton's General Scholium. In the first edition of 1687, Newton published only three rules. The first is the "Principle" of simplicity: "*We are to admit no more of natural things than such as are both true and sufficient to explain their appearances.* To this purpose the philosophers say that Nature does nothing in vain."[56] Newton is fond of the proposition that "Nature does nothing in vain." In Query 28 of the *Opticks*, he gives this proposition as an example of the sort of question that it is the "main Business of natural Philosophy" to answer by arguing "from Phaenomena," i.e., it is a speculative question: "Whence is it that Nature doth nothing in vain . . . ?"[57] To ascertain the answer, he states that we must argue from phenomena and not from speculative metaphysical hypotheses.

Rule II states that "*to the same natural effects we must, as far as possible, assign the same causes.*" Hume, of course, later puts this principle into the mouth of his character, Cleanthes, in his *Dialogues concerning Natural Religion*, who supposes that "this principle"—"That like effects arise from like causes"—is the "foundation of all religion."[58]

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ought ever to precede the Method of Composition. *This Analysis consists in making Experiments and Observations*, and in drawing general Conclusions from them by *Induction*, and admitting of no Objections against the Conclusions; yet *it is the best way of arguing which the Nature of Things admits of*, and may be looked upon as so much the stronger, by how much the Induction is more general. And *if no Exception occur from Phaenomena, the Conclusion may be pronounced generally*. But *if at any time afterwards any Exception shall occur from Experiments, it may then begin to be pronounced with such Exceptions* as occur. By this way of Analysis we may proceed from Compounds to Ingredients, and from particular causes to more general ones, till the Argument end in the most general. This is the Method of Analysis: And the *Synthesis consists in assuming the Causes discover'd and establish'd as Principles, and by them explaining the Phaenomena proceeding from them,* and proving the Explanations."

[56] *Sir Isaac Newton's Mathematical Principles of Natural Philosophy and His System of the World*, trans. Andrew Motte (1729) and rev. Florian Cajori, 2 vols, (Berkeley and Los Angeles: University of California Press, 1962), 2: 398.

[57] Newton, *Opticks*, Query 28, p. 369. Cf. William Whiston, *Sir Isaac Newton's Corollaries from his own Philosophy and Chronology; in His Own Words* (London 1729), p. 2.

[58] For Rule II, see *Sir Isaac Newton's Mathematical Principles of Natural Philosophy and His System of the World*, 2: 398. For Cleanthes' position see Hume, *Dialogues*, passim, but especially the sources of the citation in the text, Part VI, p. 170. In his first statement of the design argument in the *Dialogues*, p. 143, Cleanthes shows the efficacy of this Newtonian "Principle" for the purposes of the design argument: "Look round the world: Contemplate the whole and every part of it: You will find it to be nothing but one

In Rule III, Newton sounds remarkably like Descartes who asserts that extension is the rationally necessary essence of matter: "*The qualities of bodies, which admit neither intensification nor remission of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed the universal qualities of all bodies, whatsoever.*"[59]

These "Rules of Reasoning" are first published in 1687 in the first edition of the *Principia*. In the second edition of 1713, Newton added his famous fourth "Rule":

> *In experimental philosophy we are to look upon propositions inferred by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions*.
>
> This rule we must follow, that the argument of induction may not be evaded by hypotheses.[60]

I want to argue, at this point, that it is at least a possibility that Newton may have realized that his first three rules, if not modified, would eliminate the possibility of God "violating" natural law and that he added the fourth "Rule" to allow for modifying the "Principles" we claim to know in the event that such a future contingency actually comes to pass. The main theological and metaphysical import of Newton's most famous methodological statement in his fourth "Rule" of reasoning is that, however much confirmed by past experimentation any natural "law" or probationary "Principle" is, we must be open to the possibility that, in the future, the natural "laws" which we have hitherto perhaps *always* experienced to hold as fixed and certain may possibly be "violated." Newton's scientific procedure, regulated and corrected by the addition of the fourth "Rule," reflects his openness to the possibility that God may contravene his own laws in the future. In a new heaven and a new earth, or perhaps tomorrow, anything is possible given the ubiquitous and total power of the Lord God of creation. Newton's view about the contingency of human knowledge, in the light of God's absolute power and dominion over every aspect of creation, seems to parallel that of Robert Boyle who writes that:

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great machine, subdivided into an infinite number of lesser machines, which again admit of subdivisions, to a degree beyond what human senses and faculties can trace and explain. All these various machines, and even their most minute parts, are adjusted to each other with an accuracy, which ravishes into admiration all men, who have ever contemplated them. The curious adapting of means to ends throughout all nature, resembles exactly, though it much exceeds, the productions of human contrivance; of human design, thought, wisdom, and intelligence. Since therefore the effects resemble each other we are led to infer, by all the rules of analogy, that the causes also resemble; and that the Author of nature is somewhat similar to the mind of man; though possessed of much larger faculties, proportioned to the grandeur of the work, which he has executed. By this argument *a posteriori*, and by this argument alone, we do prove at once the existence of a Deity, and his similarity to human mind and intelligence."

[59] *Sir Isaac Newton's Mathematical Principles of Natural Philosophy and His System of the World*, 2: 398.

[60] Ibid., 2:400.

> in this very phenomenal world of partial regularity, at any moment all our science may be upset by the elimination, or change of regularity through the operation of Him who is the guider of its concourse. For the most optimistic investigator must acknowledge that if God be the author of the universe, and the free establisher of the laws of motion, whose general concourse is necessary to the conservation and efficacy of every particular physical agent, God can certainly invalidate all experimentalism by withholding His concourse, or changing those laws of motion, which depend perfectly upon His will, and could thus vitiate the value of most, if not all the axioms and theorems of natural philosophy. Therefore reason operating in the mechanical world is constantly limited by the possibility that there is not final regularity in that world, and that existential regularity may readily be destroyed at any moment by the God upon whom it depends.[61]

Because of God's sovereign nature as "Lord God" whom we "reverence and worship upon Account of his *Dominion*,"[62] the laws of nature are, in an important sense, *both* necessary *and* contingent. They are necessary—and thus knowable by the double method—*only* while God, who created them, maintains them in operation. Nevertheless, Newton accepts the possibility of direct divine contravention of natural law and all empirically grounded probationary "Principles" through miraculous ("specially provident") acts of will (which are simultaneously supremely acts of power) which interrupt the ordinary coursing of nature and nature's generally provident laws. Newton's reading of prophecy leads him to expect a "new heaven and a new earth" when the laws and principles of the current system may no longer apply and, most importantly, he seems to build this religious belief into his empirical, scientific methodology. Here and now, and for the time being, "nature is simple" and "like effects show like causes." Tomorrow, new experimental data may invalidate even such solidly grounded probationary "Principles." For Newton, the primacy of God's power results in a distinctive contingency in the natural order even while Newton acknowledges the virtual necessity of that order in its ordinary ("generally provident") current operation. Newton's fourth "Rule" may be founded upon his view that the whole of creation is "subordinate to [God], and subservient to his Will."[63] Because the future need not resemble

[61] Robert Boyle, *Reconcilableness of Reason and Religion*, in *The Works of the Honourable Robert Boyle*, 4:161.

[62] William Whiston, *Sir Isaac Newton's Corollaries from his own Philosophy and Chronology; in His Own Words*, p. 10. *Sir Isaac Newton's Mathematical Principles of Natural Philosophy*, General Scholium, 2:546.

[63] Newton, *Opticks*, Query 31, p. 403. It seems very likely that this aspect of Newton's metaphysical viewpoint is influenced by his reading of Moses Maimonides' *De Idolatria*. In addition to the immediate cultural influences shared by all writers of Newton's day, the influence of Maimonides' voluntarism and of Maimonides' concomitant view about the nature of idolatry are crucial to the development of Newton's theology. Cf. Manuel, *The Religion of Isaac Newton*, p. 87, and Brian P. Copenhaver, who corrects Manuel's overly rationalistic interpretation of Maimonides' thought, "Jewish Theologies of Space in the Scientific Revolution: Henry More, Joseph Raphson, Isaac Newton and their Predecessors," *Annals of Science* 37 (1980), p. 545. Moses Maimonides' brief tract, *De Idolatria*, was translated into Latin and edited by

the past, we must regard propositions and probationary "Principles" as only "*very nearly true . . . till such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions.*" I am suggesting that the "*other phenomena*" which Newton wants to integrate into his method as really possible future contingencies are precisely Humean miracles which, if they actually occurred, would then show how our best previously received "Principles" had been, in fact, "*liable to exceptions*."

Newton's fourth "Rule" seems to codify Boyle's clear understanding that:

> God can certainly invalidate all experimentalism by withholding His concourse, or changing those laws of motion, which depend perfectly upon His will, and could thus vitiate the value of most, if not all the axioms and theorems of natural philosophy.

The Case of Samuel Clarke: The Debate with Leibniz Reconsidered

For Leibniz, the famed Newtonian notion that the creator so badly mangled creation that, "from time to time," it wants a "Reformation" is scandalous. In 1715, he writes to Princess Caroline of Wales (later Queen Caroline) of his fears that Newton's notion of God is one of the primary causes of the moral lapses so evident in the England of their day. The exchange of volleys between Leibniz and Clarke is first published in 1717. In *The Leibniz-Clarke Correspondence*, Clarke argues that it is precisely because God can and does providentially *re*-interpose himself within the created order of natural law to govern directly his creation as the Lord God of particular providence that Leibniz levels against the Newtonians the charge of reducing God to an inferior clock repairman. "According to this Newtonian doctrine," scoffs Leibniz, "God Almighty wants to *wind up* his watch from time to time: otherwise it would cease to move. He had not, it seems, sufficient foresight to make it a perpetual motion."[64]

Clarke replies, in general, that Leibniz misunderstands the totality of divine providence due to his *a priori* doctrines of pre-established harmony and windowless monads which leave God without any sort of continuing, i.e., specially

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Dionysius Vossius, the son of the noted seventeenth-century taxonomical doxographer, Gerardus Joannis Vossius. Young Vossius died before printing his edition of Maimonides' tract. His father, G. J. Vossius, published his son's edition of *De Idolatria* with his own massive commentary on the text. Newton owned a copy of this work which is "very extensively dog-eared . . . ." Cf. John Harrison, *The Library of Isaac Newton* (Cambridge: Cambridge University Press, 1978) p. 258.

[64] "Mr. Leibnitz's First Paper," in *The Leibniz-Clarke Correspondence*, p. 11. See also *Leibniz Selections*, ed. Philip P. Wiener (New York: Scribners, 1951), p. 216. Henning Graf Reventlow has also described this attempt by Newton and Clarke to synthesize general providence and special providence in order to retain a "personal God" and to guard against a "consistent rationalism." For Reventlow, again, "This is probably the most important issue in Clarke's correspondence against Leibniz." See, *The Authority of the Bible and the Rise of the Modern World*, p. 340.

provident, dominion following his initial act of generally provident creation and, with it, the programming of the mechanized world order to unfold in accord with God's foreknowledge encoded in the fixed and irrevocable laws of nature. On Leibniz's view, the sins of mankind, for example, are foreseen through God's prescience at the moment of his generally provident creation when he also pre-ordains—programs—the Flood as a just punishment. The only sort of Providence which counts for Leibniz is God's creative general providence which is omniscient and perfect. If one shears this position of its Leibnizian metaphysical trappings of windowless monads and so forth, one is left, finally, with an interpretation of Clarke which fits nicely into the *Medievalist-Rational* school of interpretation whose essentially Augustinian position is, again, that "In one way or another the marvelous events set down by Moses in the Pentateuch could be demonstrated to fall within the mechanistic order of nature."[65]

However, for Clarke and for all the Newtonians, in contrast, it corresponds much more closely with the true nature of God's providential dominion, and redounds to his greater glory, that God fabricates the universal natural order so that it may be canceled and superseded from time to time by direct, specially provident, contra-causal, immediate interpositions of the divine will. It is quite true that, ordinarily, the generally provident laws of nature established at creation are all that is necessary, as far as Clarke is concerned, for the governance of the Lord God's dominion over man and nature. Clarke does in fact argue, in the sort of passage which, for example, Peter Harrison emphasizes, e.g., that "the wisdome of God consists in framing originally the perfect and complete idea of a work, which begun and continues, according to that original perfect idea, by the continual uninterrupted exercise of his power and government."[66]

And when Leibniz ridicules the Newtonian conception that the everyday operation of gravity is itself an instance of a kind of specially provident miracle,[67] Clarke does in fact reply that a miracle is what is unusual in nature and so, because the operation of gravity is regular and constant, "'tis no miracle, whether it be effected immediately by God Himself, or mediately by any created power."[68] Thus, in Clarke's Boyle Lectures, he occasionally sounds like William Whiston when Whiston states that gravity results from a cause "superior to matter *continually* exerting on it a certain force or power" and thus that the world depends "every moment on some superior being, for the preservation of its frame."[69] Clarke similarly asserts that "The Course of Nature truly

[65] Peter Harrison, "Newtonian Science, Miracles, and Laws of Nature," p. 539.

[66] "Dr. Clarke's Second Reply," in *The Leibniz-Clarke Correspondence*, p. 22.

[67] "Mr. Leibnitz's Third Paper," in *The Leibniz-Clarke Correspondence*, pp. 29–30; "Mr. Leibnitz's Fourth Paper," Ibid., pp. 42–3; "Mr. Leibnitz's Fifth Paper," Ibid., pp. 91–5. Cf. *Leibniz Selections*, pp. 227–8, 235, and 275–8.

[68] "Dr. Clarke's Third Reply," in *The Leibniz-Clarke Correspondence*, p. 35.

[69] Clarke, *Works*, 2:601. Cited by H. G. Alexander in his Introduction to *The Leibniz-Clarke Correspondence*.

and properly speaking is nothing else but the *Will of God* producing certain Effects in a continued, regular, constant and uniform Manner which . . . being in every Moment perfectly *Arbitrary*, is as easy to be altered at any time, as to be *preserved*."[70]

But a continuous "miracle" which "sustains" the laws of nature in their current operation, finally, is only one kind of direct, specially provident interposition of arbitrary, omnipotent Divine will into the generally provident, created order of nature. There always remains, for the Newtonians, the possibility for another sort of direct display of particular providence. As with Newton and Whiston, Clarke never strays from his commitment to the possibility of miracles as the direct and explicit *re*-interposition of God's omnipotent will directly back into the world thereby, in an exceptional act, canceling and superseding created natural law. To repeat, in his Boyle Lectures for 1705, Clarke writes that a miracle:

> is a work effected in a manner *unusual* or different from the common and regular method of Providence by the interposition either of God Himself, or some intelligent agent superior to man, in the proof or evidence of some particular doctrine or in attestation to the authority of some particular person.[71]

For the Newtonians, God's present dominion—and the ever present possibility of his direct interposition of his power to alter nature and his prophetic promises to re-interpose himself within his creation in the future—is both the anchor for the emotional power of religion and the source of its greatest evidence in the scriptural history of God's particular providence throughout history. Newton's God is present and able, should he decide to do so, to intervene in the generally provident natural laws which ordinarily regulate a sparrow's flight. God listens to prayer and he is able, *if* he chooses, to answer directly in a manner quite exceptional to the ordinary coursing of nature. Clarke explains his view to Queen Caroline with an apt political analogy:

> As those men, who pretend that in an earthly government things may go on perfectly well without the King himself ordering or disposing of anything, may reasonably be suspected that they would very well like to set the King aside . . . ., so too those who think that the universe does not constantly need "God's actual government" but that the laws of mechanism alone would allow phenomena to continue, in effect to exclude God without the World.[72]

[70] Cited in Ezio Vailati, *Leibniz & Clarke. A Study of their Correspondence* (New York: Oxford University Press, 1997), pp. 141–2.

[71] Clarke, *A Discourse Concerning the Unchangeable Obligations of Natural Religion, and the Truth and Certainty of the Christian Revelation, Being Eight Sermons Preached at the Cathedral Church of St. Paul in the Year 1705*, in *A Defence of Natural and Revealed Religion*, 2:165.

[72] Cited in David Kubrin, "Newton and the Cyclical Cosmos," *Journal of the History of Ideas* 28 (1967), p. 329.

Conclusion

Newton does not appear to be some sort of late-blooming Medieval schoolman inquiring about whether God is so powerful that he is able to create a stone so heavy that he cannot lift it. Such conundrums are contrary to the simple piety and reverence for the Lord God which he promotes in all his writing. With others in the modern reforming school from Erasmus (who has no time for the folly of inquiring so closely into God's powers and prefers pious acceptance of literal tales of miracles in the Bible) to his near contemporaries in the early Royal Society, Newton emphasizes literal faith in Biblical stories of miraculous events. Even if most of them can be explained, at least in part, in terms of mechanism, the opening is always left that some aspect of them may not be.

In the unique Newtonian synthesis of God's creative general providence and his power to govern creation by interposing his will directly into the natural and human order which he created, the Newtonians tend generally to emphasize God's creative general providence. They nevertheless strive to retain both a generally provident celestial artificer and a specially provident Lord God fully capable of *both* directly interposing his will into created nature and of doing so in a way which contravenes, or "violates," created natural law.

Either when pressed by Leibniz about the Newtonian reduction of God to the status of an inferior clock repairman or when considering scriptural reports of phenomena for which there is no apparent mechanical explanation to confute deistic mockery of scripture, the Newtonians attempt to retain both a generally and a specially provident—interventionist, miracle-working—deity.

In the end, we simply must make room in our interpretation of Newtonian voluntarism for a God sufficiently powerful to intercede in nature to effect changes in natural law in a manner which transcends those laws and guarantees that they are not purely random acts or the result of mere chance. In his *New Theory of the Earth*, William Whiston describes this aspect of the nature of the Lord God's power. Whiston writes that the Noachian deluge "was a sign . . . of the Divine Vengance [sic] on a wicked World, and was the effect of the peculiar and extraordinary Providence of God." The Lord God has the power to effect the timing of the comet's return to coincide with the precise moment in human history when the human race needed to be taught a lesson. Whiston thus concludes that the periodic return of Halley's comet, while not in itself miraculous, "yet is there the greatest reason in the World to attribute this mighty Turn and Catastrophe of Nature, to the Divine Providence, and the immediate, voluntary, actual, interposition of God." Because the comet's orbital return coincides with the precise moment when God prophesied to Noah that the flood would come to pass at the very instant when the sins of

mankind required divine vengeance, we have sufficient historical evidence of God's "immediate, voluntary, actual interposition of God."[73]

But, built into Newton's empirical approach to obtaining probabilistic knowledge of nature and scripture, is the possibility of an intervening, law-contravening Lord God who, in the future, may choose to display his power in a strict Humean miracle, an event which effectively breaks or transgresses his own created laws. We humans certainly cannot rule such a possibility out given that the sure word of science, not to mention the sort of prophetic prediction which God made to Noah about the flood to come, is founded on God's absolute power. Moreover, given the ubiquitous nature of his power, Humean miracles are at least possible even if God has worked through secondary causes throughout *all* recorded history since creation up to this very moment. We cannot rule out the possibility of future miraculous interpositions of his will sequentially timed to drive home God's moral lessons to fallen mankind. Although we may legitimately expect the future to resemble the past and also to expect that the "known" laws of cause-and-effect will continue to apply in the future as they have been observed to apply in the past, we cannot discount the very real possibility that they may not.

It is as if the Newtonians hedge their bet about the nature of God's power. On the one hand, fulfilled historical prophecies evidence a sort of mild voluntarism by displaying, as an active and directly guiding force in the history, an "immediate, voluntary, actual interposition of God." On the other, they seem unwilling to preclude the possibility that, in the future, a more absolute sort of voluntaristic action by God—an action which rends completely nature's laws—may be possible.

[73] William Whiston, *A New Theory of the Earth*, 1st ed. (London, 1696), p. 357. My thanks to Steve Snobelen for pointing this text out to me.

ESSAY 6

Eighteenth-Century Reactions to Newton's Anti-Trinitarianism[1]

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> I have differed from the sentiments of two very Great and Extraordinary Men, but in Points so clear, that I trust, I shall be acquitted of all Pride and Petulance. Great Men love to have their peculiar Notions, and Singularitys, and it cannot be expected that the World should subscribe implicitly to their Opinions. Mr *Locke* I have long thought to have been mistaken in some Points of Philosophy: and the incomparable Sir *Isaac Newton* happens *demonstrably* to be so in the *Egyptian* Chronology.[2]

The late 1720s and early 1730s were charged with potential difficulties for the Church of England. Some of the problems that churchmen confronted were the result of the breakdown of the Church's political accommodation with the government of Robert Walpole. These culminated in 1736 with abortive attempts to repeal the Test and Corporation Acts and the successful passage of both the Mortmain Bill and the Quakers' Tithe Bill. The failure of opposition to these two bills, which compromised testamentary benefactions to ecclesiastical charities and threatened clerical incomes, effectively terminated the close relationship that had existed between Walpole's ministry and Edmund Gibson, Bishop of London. This had already been strained by the interference of the new Queen, Caroline of Ansbach, in appointments to the clerical hierarchy

[1] Some of this essay has already appeared in different form as part of "Newton and eighteenth-century Christianity" in *The Cambridge Companion to Newton*, ed. I. Bernard Cohen and George E. Smith (Cambridge: Cambridge University Press, 2002), pp. 409–30. I am grateful to Jean-François Baillon, Tabitta van Nouhuys, Steve Snobelen, and John Walsh for their generous assistance on various matters.

[2] Henry Felton, *The Christian Faith Asserted against Deists, Arians, and Socinians* (Oxford, 1732), p. lxxxvii.

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 93–111.
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and by her continued patronage of churchmen, for example Newton's disciple Samuel Clarke, who mixed their toleration of dissenters with avant-garde or even heterodox theological views.[3] Moreover, clerical anxiety about the security of the future stewardship of the Church was compounded by sensitivity to a recrudescence of radical criticism of mainstream Christian doctrine. In a series of pastoral letters to the people of his diocese, Gibson had placed himself at the forefront of the defenders of orthodoxy, particularly against those who would deny the status and miracles of Christ or argue for the sufficiency of a religion based on reason.[4] When Henry Felton entered the pulpit at St Paul's to denounce Locke and Newton, his concerns were very similar to those of the Bishop of London.

In 1728, Isaac Newton's heirs had succeeded in publishing an edition of *The Chronology of Ancient Kingdom's Amended*. Based on passages culled from Newton's theological manuscripts, this work was dedicated to Queen Caroline, who had encouraged its composition. As Princess of Wales, Caroline had helped to provoke controversy between Newton and several French chronologists, notably Nicolas Fréret, by allowing the Abbé Conti to take a copy of Newton's "Short Chronicle" from a manuscript in her possession.[5] Fréret's principal concern was to contradict the radical abbreviation that Newton had introduced into ancient chronology. This was also the point at which Felton chose to attack Newton. But this apparently pedantic quarrel about dates became far more serious once Newton's heirs had followed up their publication of the *Chronology* with further gleanings from his manuscripts.

Newton's *Observations upon the Prophecies of Daniel, and the Apocalypse of St. John*, prepared for the press from his manuscripts by his nephew Benjamin Smith, was published in two editions in London and Dublin in 1733.[6] According to Richard S. Westfall, Newton's finest twentieth-century

[3] See Norman Sykes, *Edmund Gibson* (London: Oxford University Press, 1926), pp. 122–82; Stephen Taylor, "Sir Robert Walpole, the Church of England and the Quakers' Tithe Bill of 1736," in *Historical Journal*, 28 (1985), pp. 51–77; Stephen Taylor, "Queen Caroline and the Church of England," in *Hanoverian Britain and Empire*, ed. Stephen Taylor, Richard Connors, and Clyve Jones (Woodbridge: The Boydell Press, 1998), pp. 82–101.

[4] Edmund Gibson, *The Bishop of London's Three Pastoral Letters* (London, 1732).

[5] See Frank E. Manuel, *Isaac Newton. Historian* (Cambridge: Cambridge University Press, 1963), pp. 21–36; Karin Figala, "Ein Exemplar der Chronologie von Newton aus dem Besitz von Pierre Des Maizeaux in der Bibliothèque de la Ville de Colmar," in *Verhandlungen der Naturforschenden Gesellschaft in Basel*, 84 (1973), pp. 646–97; Blandine Kriegel, "Nicolas Fréret chronologiste," in *Nicolas Fréret, légende et vérité*, ed. Chantal Grell and Catherine Volpilhac-Auger, (Oxford: Voltaire Foundation, 1994), pp. 89–108; Nicolas Fréret, *Défense de la chronologie fondée sur les monumens de l'histoire ancienne,* [ed. J.-P. de Bougainville] (Paris, 1758).

[6] See Richard S. Westfall, *Never at Rest* (Cambridge: Cambridge University Press, 1980), pp. 815–20, 872–3; Jewish National and University Library, Jerusalem, MS Yahuda Var. 1/ (Yah. Ms.) 7.2b, fols 1–9 and 7.2j, fols 1–139; Yah. Mss 7.1, 7.2, and parts of 7.3 contain drafts which relate to the preparation of the book, see also Cambridge University Library (CUL), MS Add. 3989 (3); some surviving proof sheets can be found in the Hampshire County Record Office, Winchester, MS NC 10.

biographer, the author "had cleansed his *Observations*" and his heirs "could publish the manuscript without concern."[7] Yet one might be permitted to wonder whether either the actual or the intended reception of Newton's posthumous work was as uncontroversial as it has seemed to late twentieth-century eyes. The book was dedicated to Peter King, baron of Ockham, the Lord Chancellor, who had defended Newton's sometime disciple, William Whiston, during his trial for heresy in July 1713.[8] Although Whiston later fell out with King, he nevertheless continued to maintain that King's youthful writings on the primitive church supported the Arian position for which he had himself been condemned.[9] King was also the dedicatee of other works of dubious theological orthodoxy, such as Daniel Mace's attempted revision of the New Testament. Mace showed little respect for the authenticity of the two New Testament texts that most clearly upheld the orthodox doctrine of the Trinity, I John 5:7 and I Timothy 3:16. Listing ancient manuscripts that gave non-Trinitarian readings, he hinted strongly that their modern, orthodox variants were the product of interference with the primitive text of scripture.[10]

The young King's most significant friendship had been with his second cousin, John Locke, who was later chosen as an adversary by many churchmen, including Henry Felton. King was one of the philosopher's closest confidants towards the end of his life and an executor of his will, by which he inherited half of Locke's library and all of his manuscripts. He was also charged with "a little packet sealed up and directed to Mr Newton."[11] King had acted as an occasional intermediary between Newton and Locke, passing on information between the two men about matters concerning the Mint and about the interpretation of scripture. He conveyed chapters of the draft of Locke's *A Paraphrase and Notes on the Epistles of St. Paul* to Newton for comment.[12] Locke informed King that Newton was "really a very valuable man not onely

[7] Westfall, *Never at Rest*, p. 817.

[8] William Whiston, *Memoirs of the Life and Writings of Mr. William Whiston*, 2 vols (London, 1749), 1:227; Eamon Duffy, "Whiston's Affair: the trials of a Primitive Christian 1709–1714," in *Journal of Ecclesiastical History*, 27 (1976), pp. 129–50.

[9] Whiston, *Memoirs*, vol. 1, pp. 35, 362, 484; James E. Force, *William Whiston. Honest Newtonian* (Cambridge: Cambridge University Press, 1985), p. 99; cf. [Peter King], *An Enquiry into the Constitution, Discipline, Unity and Worship of the Primitive Church* (London, 1691) and Peter King, *The History of the Apostles Creed* (London, 1702).

[10] [Daniel Mace], *The New Testament in Greek and English*, 2 vols (London, 1729), 1: iii–vii; 2: 772–3; 917, 921–35.

[11] *The Correspondence of John Locke*, ed. E. S. de Beer, 8 vols (Oxford: Clarendon Press, 1976–89), 8: 412–17, 419–27 (quotation at p. 415); John Harrison and Peter Laslett, *The Library of John Locke* (Oxford: Oxford Bibliographical Society, 1965), pp. 54–6; Maurice Cranston, *John Locke* (Oxford: Oxford University Press, 1985), pp. 438–9, 449–82.

[12] *Locke Correspondence*, 8: 404–6; John Locke, *A Paraphrase and Notes on the Epistles of St Paul*, ed. Arthur W. Wainwright, 2 vols (Oxford: Clarendon Press, 1987), 1: 6–11; John Marshall, *John Locke—Reason, Resistance and Responsibility* (Cambridge: Cambridge University Press, 1994), pp. 390–2.

for his wonderfull skill in Mathematicks but in divinity too and his great knowledg in the Scriptures where in I know few his equals."[13] As an acquaintance of Newton and a prominent whig politician, King may therefore have been a natural choice as the dedicatee of the *Observations*. But, as his earlier doctrinal sympathies, his knowledge of suspicions that had been voiced about Locke's orthodoxy on the matter of the Trinity, and his later patronage of heterodox Presbyterians such as Mace make clear, King was not a theologically neutral choice as a patron of a work of biblical interpretation.[14] Moreover, as the owner of Locke's manuscripts, King had access to evidence of Newton's heterodox beliefs about the Trinity, in the letters that passed into his keeping at Locke's death.[15] It is tempting to speculate that the "little packet" that King had been charged with returning to Newton might have contained a more incriminating piece of correspondence, sent by Newton to Locke in 1690 but no longer extant among Locke's papers: Newton's initial letters comprising *An Historical account of two Notable Corruptions of Scripture*, I John 5:7 and I Timothy 3:16.[16] King was not displeased by the dedication of *Observations*, granting Smith a mediety of the rectory of Linton in Craven, Yorkshire.[17]

By 1733, therefore, Newton's heirs had published two substantial, but highly confused, selections from the theological works that they had inherited. Although they did not reveal Newton's heterodoxy openly, both of these books hinted broadly at revisions in traditional thinking about the past, including Christian history. Moreover, each was dedicated to a powerful patron, sympathetic to religious heterodoxy and with the influence to mould ecclesiastical preferment. The implications of these publications did not go unremarked. Commenting on the plans for the publication of the *Chronology*, Newton's physician, Richard Mead, argued that he "was a christian, believed revelation, though not all the doctrines which our orthodox divines have made articles of faith."[18] Although Newton's French admirer, Voltaire, felt that the *Chronology* had merely been an amusement that provided relief from "the Fatigue of his severer Studies," he nevertheless revealed in 1733 that "this philosopher thought that the Unitarians argued more mathematically than we

[13] *Locke Correspondence*, 7: 773. For exchanges of information on the prophecies of Daniel and Revelation between Newton and Locke, see Bodleian Library, Oxford, Ms. Locke c. 27, fol. 88; Ms. Locke fol. 32, fol. 143v; *The Holy Bible* (London, 1648) [Bodleian Library, Locke 16.25], pp. 859, 866; *The Holy Bible* (London, 1654) [Locke 10.59–60], vol. 2, fifth interleaved page.

[14] *Locke Correspondence*, 6: 522.

[15] *The Life of John Locke*, ed. Peter, seventh Lord King (London, 1829), pp. 215–33.

[16] New College, Oxford, Ms. 361.4, fols 2–41; printed in *The Correspondence of Isaac Newton*, ed. H. W. Turnbull et al., 7 vols (Cambridge: Cambridge University Press, 1959–77), 3: 83–122; Newton had attempted to reclaim these papers as early as 26 January 1692, see *Newton Correspondence*, 3: 192–3.

[17] John Nichols, *Illustrations of the Literary History of the Eighteenth Century,* 8 vols (London, 1817–58), vol. 4, pp. 33–4.

[18] *The Family Memoirs of the Rev. William Stukeley*, ed. W. C. Lukis, 3 vols (Durham: Surtees Society, 1880–7), 1: 424–5.

do."[19] Following the publication of the *Chronology* and the *Observations*, others searched for proof of these allegations and were less than generous to Newton's beliefs and intentions.

The Bristol clergyman, orientalist, and moral reformer, Arthur Bedford directed his initial criticisms at the astronomical methods of dating that Newton's chronology had deployed.[20] He pointed out that Newton's findings disagreed with those of the most prominent orthodox writers on chronology—James Ussher, William Lloyd, Richard Cumberland, and William Beveridge, all of whom were in agreement about the major dates in secular and sacred history.[21] But he soon identified his real target: "we live in an Age, when we cannot be too cautious . . . The *Divinity* of our blessed SAVIOUR is struck at by the Revivers of ancient and modern Heresies; especially that, which destroyed all the eastern Nations, and introduced *Mahometism* among them."[22]

Bedford was perceptive in noticing that Newton's conclusions about sacred history created doubts over the authority and antiquity of scripture.[23] He felt these were reminiscent of the beliefs of Newton's disciples, Whiston and Clarke, and therefore raised the spectre of Arianism. This heresy had swept through the eastern Church in the early fourth century, weakening it both theologically and politically. Its beliefs about Christ's nature as the first of God's creations, rather than as God himself, seemed to people like Bedford the most blasphemous of the primitive heresies that were currently being revived by Whiston and, more cautiously, Clarke.[24]

[19] Voltaire, *Letters concerning the English Nation* (London, 1733), quotations from pp. 122 and 48 respectively.

[20] Wiltshire Record Office, Trowbridge, Ms. 1178/631. On Bedford, see "The Society for the Reformation of Manners 1700–5," ed. Jonathan Barry, in *Reformation and Revival in Eighteenth-Century Bristol*, ed. Jonathan Barry and Kenneth Morgan, Bristol Record Society's Publications 45 (Stroud: Alan Sutton,1994), pp. 1–62; William Weber, *The Rise of Musical Classics in Eighteenth-Century England* (Oxford: Clarendon Press, 1992), pp. 47–56.

[21] Arthur Bedford, *Animadversions upon Sir Isaac Newton's Book, Intitled the Chronology of Ancient Kingdoms Amended* (London, 1728), p. 5; see also Bedford, *The Scripture Chronology demonstrated by Astronomical Calculations* (London, 1730), pp. v–vi. Cf. James Ussher, *Annales Veteris Testamenti* (London, 1650); the chronological information which had been provided in large format English Bibles since an edition published by Lloyd at Oxford in 1701; Benjamin Marshall, *Chronological Tables*, 2 parts (Oxford, 1712–13), which were based on more detailed work by Lloyd; Richard Cumberland, *Sanchoniatho's Phoenician History*, ed. S. Payne (London, 1720); William Beveridge, *Institutionum chronologicarum libri II*, 2nd edition (London, 1705). Newton's copies of these works, with the exception of Marshall, survive in the library of Trinity College, Cambridge, shelfmarks Tr/NQ.10.1; Tr/NQ.9.16; Tr/NQ.8.96; see John Harrison, *The Library of Isaac Newton* (Cambridge: Cambridge University Press, 1978). Cf. Benjamin Marshall, *A Chronological Treatise upon the Seventy Weeks of Daniel* (London, 1725), which is highly critical of Newton's preferred source, Sir John Marsham, *Canon chronicus Ægyptiacus, Ebraicus, Graecus, et disquisitiones* (Leipzig, 1676).

[22] Bedford, *Animadversions*, p. 143.

[23] Manuel, *Isaac Newton. Historian*, pp. 171–7.

[24] See Samuel Clarke, *The Scripture-Doctrine of the Trinity* (London, 1712); William Whiston, *Primitive Christianity Reviv'd* (London, 1712); Eamon Duffy, "Primitive Christianity revived: religious renewal in Augustan England," *Studies in Church History* 14 (1977), pp. 287–300.

In the months following Newton's death, speculation was rife that he had shared the heterodox beliefs for which Whiston and Clarke were pilloried. The Presbyterian minister and historian, Robert Wodrow, who was a friend of a number of Scottish Newtonians, received frequent reports about the publication of Newton's *Chronology*. As early as 1711, Wodrow had recorded rumours concerning Newton's influence on Whiston: "It is said he has not only much of his Mathematicks, but severall of his other errours from Sir Isaack Neuton, which I incline not to belive."[25] He was thus relieved to be informed in November 1727 that Newton's unpublished papers appeared at first to contain nothing about the doctrine of the Trinity. Wodrow's composure was shattered in May 1729 when he learned that Newton had agreed with Clarke about the subordination of Christ to God the Father and had had peculiar notions about the interpretation of the prophecies of Daniel.[26] In 1730, Whiston looked forward to the publication of Newton's *Observations* because of the account of Daniel's prophecy of the seventy weeks (Daniel 9.24–7) that it contained. This prophecy was traditionally interpreted as having determined that the birth of Christ, the Crucifixion, or the destruction of Jerusalem by the Romans would mark the moment when God would release his people from captivity. Whiston knew that Newton argued that it remained unfulfilled.[27] The rumours that shocked Wodrow and that Whiston promoted were the same ones that Voltaire salaciously reported and to which he drew attention in 1733. The speculation that they raised about the validation of the Christian religion through prophecy fed into wider doubts about the meaning and implications of revelation.[28] For that reason, the role of prophecy in testifying to the authenticity of Christ's claim to be the Messiah was one of the subjects that Edmund Gibson chose for the first of his pastoral letters.[29]

Although Gibson did not reflect directly on Newton's works, some of his allies did. Daniel Waterland, Master of Magdalene College, Cambridge was perhaps the most indefatigable upholder of Trinitarian orthodoxy of the time. He was a veteran of numerous controversies, notably with Samuel Clarke,

[25] Robert Wodrow, *Analecta*, ed. Matthew Leishman, 4 vols (Glasgow, 1842–3), 1: 325.

[26] Wodrow, *Analecta*, ed. Leishman, 3: 205–6, 461–2; 4: 59. For contemporary Scottish interest in Newton's religious beliefs, see also National Library of Scotland, Edinburgh, Ms. Wodrow Letters Quarto XXI, fols 75r–77v (Andrew Grey to Wodrow, 20 March 1725); *The Collected Letters of Colin MacLaurin* (Nantwich: Shiva, 1982), ed. Stella Mills, pp. 179–80 (Robert Simson to MacLaurin, 6 November 1727).

[27] William Whiston, *Historical Memoirs of the Life of Dr. Samuel Clarke* (London, 1730), pp. 156–7; cf. Newton, *Observations*, pp. 128–43. For the more orthodox interpretation, that the prophecy was completely fulfilled at the death of Christ, see Humphrey Prideaux, *The Old and New Testament Connected in the History of the Jews and Neighbouring Nations*, 2 parts (London, 1726–8), 1: 262–4; H. H. Rowley, *Darius the Mede and the Four World Empires in the Book of Daniel* (Cardiff: University of Wales Press, 1935), p. 135.

[28] See Jean-François Baillon, 'La reformation permanente: les Newtoniens et le dogme trinitaire', in *Le Christ entre orthodoxie et Lumières*, ed. Maria-Cristina Pitassi, (Geneva, 1994), pp. 123–37.

[29] Gibson, *The Bishop of London's Three Pastoral Letters*, pp. 22–61.

the deist Matthew Tindal, and Conyers Middleton and expressed straightforward opinions about Newton's theological writings and those of his allies. He attacked Clarke's duplicity with regard to the thirty-nine articles of the Church of England and the ambiguous language deployed in *The Scripture-Doctrine of the Trinity*.[30] He was equally damning about what he took to be Newton's lack of candour about the intentions and implications of his arguments in his *Chronology* and *Observations*. He thus wrote to Zachary Grey that he was

> sorry that no one yet has undertaken a just *Answer* to *Sir Isaac Newton's 14th. Chapter* relating to the *Prophecies of Daniel*: in which he slily abuses the *Athanasians*... That *Prophetical* Way of managing this Debate on the Side of *Arianism*, is a very silly one, & might be easily retorted. But besides that, what *Sir Isaac* has said, is most of it *false History*. I have scribbled the *Margin* all the way ...[31]

A particular excitement for Waterland and Grey was the possibility provided by Newton's *Observations* of catching the great mathematician out in his own calculations.[32] Since Waterland claimed he was too busy and too unwell for the task, Grey duly took up the cudgel on his behalf, thus enhancing his growing reputation as an apologist for the Church of England.[33]

The resulting attack on the fourteenth chapter of the *Observations* was unforgiving in its criticism of Newton's argument and intentions and unpleasantly insightful about his methods as a theologian and historian. Grey confronted Newton's chronology, logic, and use of sources and found all of them wanting. His target was particularly well chosen, since the chapter under review presented Newton's case for the growth of idolatry in the early Christian Church, itself a sign of Newton's broader point that the incarnation of Christ had not marked the fulfilment of Daniel's prophecies. Grey cannot have known that these had been the principal themes of Isaac Newton's theology since the 1670s, and it was only an inspired guess on his part to identify this passage as the key to the underpinning of Newton's Arian Christology in his interpretation of prophecy.[34] He argued that Newton had suppressed evidence demonstrating

[30] Daniel Waterland, *The Case of Arian-Subscription Considered* (Cambridge, 1721); British Library, London (BL), MS Add. 5831, fols 173r–174r.

[31] Waterland to Grey, 5 February 1735, BL, Ms. Add. 5831, fols 172r–3r.

[32] B. W. Young, *Religion and Enlightenment in Eighteenth-Century England. Theological Debate from Locke to Burke* (Oxford: Clarendon Press, 1998), pp. 37–8.

[33] BL, MS Add. 6396, fols 7–9, 14r; cf. MS Add. 5831, fols 173r, 182r–3r; Zachary Grey, *An Impartial Examination of the Second Volume of Mr. Daniel Neal's History of the Puritans* (London, 1736); Zachary Grey, *The Spirit of Infidelity, Detected*, 2nd edition (London, 1735).

[34] Zachary Grey, *An Examination of the Fourteenth Chapter of Sir Isaac Newton's Observations upon the Prophecies of Daniel* (London, 1736) [CUL, 7100 d.46, is Grey's own copy with his additions interleaved]. Many of Newton's unpublished theological manuscripts relate to these issues, most importantly: King's College, Cambridge, Keynes MSS 5 and 10; Yah. MSS 1, 2, 8.2, 15; Fondation Martin Bodmer, Geneva, MS "Of the Church" (Bodmer Ms.); William Andrews Clark Memorial Library, Los Angeles, MS "Paradoxical Questions concerning y^{e} morals & actions of Athanasius & his followers" (Clark MS).

that respect was given to saints and martyrs in the primitive Church which was inconvenient to his prophetic scheme. He showed that Newton had distorted the Greek Fathers, to make it appear that the early cult of martyrs' graves constituted a form of idolatry and that the first monks had perverted true Christianity. He suggested that the accusations of furthering idolatry that Newton levelled at the orthodox, Trinitarian Athanasians ought properly to be directed at the Arians themselves.[35] An earlier attack on the *Chronology* by the Cambridge divine, Arthur Young, had also pointed out that Newton had placed the origins of the worship of saints too early. Whereas Grey and Waterland were content to imply that Newton's work might give comfort to the deists, Young explicitly associated his publications with those of Tindal. He also argued that Newton's comments on figurative language and the preservation of the text of the Hebrew Bible, which Waterland had disingenuously admired, in fact "[could] not [be] more prejudicial to Christianity."[36]

Young and Grey argued that the only real beneficiary of Newton's attack on the reputation of the Fathers was the Roman Catholic Church. Grey suggested that Newton assisted its polemicists by falsely attributing corrupt Catholic doctrines to the pure, primitive Fathers.[37] Given Newton's own powerful history of anti-Catholicism, this was a remarkable conclusion. Because of the reputation of the theology of the early Church in English Protestant writing from the time of the Reformation, however, it was also justifiable.

Intellectually, one of the most powerful of Grey's criticisms of Newton's theological writings was that they distorted the meaning of the Greek Fathers. Grey noticed that Newton's quotations from writers like St Cyril of Jerusalem, St. Cyril of Alexandria, or St. Gregory of Nazianzus were often selective and that he was prone to making errors in citations (for example, confusing Sozomen with one of his sources, Socrates). Above all, the problem was that Newton often seemed to be using translations rather than the original text. This was most extreme in the case of St. Ephraem Syrus, where Newton appeared to be using a Latin translation made from a Greek version of the original Syriac text.[38] Grey had realised that Newton's method for his theological writings depended largely on the assimilation of works in English and Latin, many of which already seemed dated. Although he possessed several editions of patristic texts, Newton's Greek was probably not good enough to allow him to cope easily with the original versions of many of the sources on which he ought to have been most dependent for a history of the early Church. Where Newton did own the relevant Greek works, he did so in editions that also

[35] Grey, *Examination*, pp. 7–25, 35–58, 72–85, 103–117.

[36] Arthur Young, *An Historical Dissertation on Idolatrous Corruptions in Religion*, 2 vols (London, 1734), 2: 265–70, quotation at p. 269.

[37] Ibid. p. 268; Grey, *Examination*, p. 1.

[38] Grey, *Examination*, pp. 35, 56, 85, 109, 137, for example.

gave the text in Latin.[39] This tendency was even more marked with Newton's use of Hebrew works, where he quite shamelessly marked passages in the Latin parallel texts that later appeared as quotations in Hebrew in his own writings.[40] Newton's theological writings frequently appear to be little more than compendia of quotations; what is less apparent is that their copious citations were often constructed largely out of the compilations of previous critics.[41] Newton was not unusual among humanist scholars in employing this method of study, in which selective reading was rapidly converted into the appearance of mammoth erudition in pursuit of a particular, clearly defined goal. However, this technique worked best when the ideology informing it was an orthodox one, since, by definition, it was likely to be vulnerable to scrutiny.[42] Given the unusual nature of the case that Newton was trying to prove, it was unlikely that scholarly habits such as his would bear up well under examination.

Grey was by no means the only orthodox critic of Newton whom Waterland sponsored. In 1719, Waterland had inaugurated a lecture series, to be delivered as sermons at St. Paul's Cathedral, in defence of the doctrine of the Trinity. These lectures were supported by Rebecca Moyer, the widow of Sir Samuel Moyer, a Turkey merchant and sheriff of Essex. By her will, which was proved on 21 February 1723, Lady Moyer endowed the sermons with twenty guineas a year for "an able Minister of God's Word, to preach eight sermons every year on the Trinity, and Divinity of our ever blessed Saviour, beginning with the first Thursday in November, and so the first Thursday in the seven sequel months, in St. Paul's, if permitted there . . . "[43] Waterland was actively involved in the selection of many of the preachers at Lady Moyer's lecture, several of whom acknowledged his aid. One of these was Henry Felton, who preached the sermons for 1728–9, which attacked Newton's *Chronology* while praising his "Principles of Gravitation and Attraction, that Universal Magnetism of Nature, [which] tho' rightly assigned, cannot yet themselves be accounted for but from the Virtue, and Impression of the first great Mover."[44] Felton's juxtaposition of the usefulness of the natural theology to be derived from Newton's natural philosophy with the shortcomings of his writings as a biblical critic certainly

[39] See Harrison, *Library of Isaac Newton*, pp. 128 (St. Cyril of Jerusalem), 153 (St. Gregory of Nazianzus).

[40] Thus Newton's copy of Moses Maimonides, *De idololatria liber*, ed. Dionysius Vossius (Amsterdam, 1641) [Tr/NQ.8.46[1]], at p. 168.

[41] For example, Gerardus Joannes Vossius, *De theologia Gentili* (Amsterdam, 1641) [Tr/NQ.8.46[2]], in which Newton has frequently chosen to mark Vossius's Latin paraphrases rather than the original Greek.

[42] Anthony Grafton, "The Humanist as Reader," in *A History of Reading in the West*, ed. Guglielmo Cavallo and Roger Chartier, trans. Lydia G. Cochrane (Cambridge: Polity Press, 1999), pp. 179–212.

[43] Daniel Waterland, *Eight Sermons Preach'd at the Cathedral Church of St. Paul, in Defense of the Divinity of Our Lord Jesus Christ* (Cambridge, 1720); *The Works of the Rev. Daniel Waterland, D. D.*, ed. William van Mildert, 10 vols (Oxford, 1823–8), 1: 65–7, quotation at p. 65.

[44] Felton, *The Christian Faith Asserted*, pp. ii, v–vi. Others who explicitly acknowledged Waterland's aid or example included William Berriman (1723–4) and Joseph Trapp (1729–30).

chimed with the characterisation of Newton's work that Waterland and his allies had been developing.

The Moyer lectures in general echoed Waterland's criticisms of Samuel Clarke and often targeted the ideas of William Whiston. William Berriman, for example, who preached the sermons for 1723–4, had already cut his teeth in arguments with Whiston and used his lectures at St. Paul's to advance an orthodox interpretation of the patristic sources for the Arian controversy in the early Church.[45] Joseph Trapp attacked the notion that "the Word *God* in these sacred Writings denotes . . . but *Office* only, *Dominion*, or *Authority*," in the process taking up one of Waterland's cudgels against Clarke and also reflecting critically on the language used by Newton in the General Scholium to the second edition of the *Principia* (1713). Trapp revealed himself to be a subtle reader of Newton, alert to the chance to turn a nuanced argument on its head. In the General Scholium, Newton had suggested that God "rules all things, not as the world soul but as the lord of all. And because of his dominion he is called Lord God *Pantokrator*." Some modern critics have seen in this passage evidence of Newton's exclusive view of the deity of God the Father and therefore covert signs of his Arian Christology. It seems likely that Trapp would have agreed with them, since he developed his own argument to suggest that the word *Pantokrator* had to be read in the context of Isaiah 43:10–44:6 and was properly an explicit reference to the power of "*governing*, *containing*, *supporting*, and *upholding* all things" exercised by Christ.[46]

Another lecturer on Lady Moyer's foundation almost certainly had both the *Principia* and Newton's published theological works in his sights when he preached that the first-century Alexandrian philosopher Philo had conceived of a divine Trinity consisting of three equal persons. In the General Scholium, Newton had quoted from Philo's works when setting out his own definition of the nature of God. But, according to Arthur Bedford, who delivered the Moyer lectures in 1739–40, Philo had in fact written about "some Kind of Plurality in the Divine Nature" in which there were two other persons, in addition to God the Father, who "made and do govern the World, that they are not to be

[45] William Berriman, *An Historical Account of the Controversies that have been in the Church concerning the Doctrine of the Holy and Everblessed Trinity* (London, 1725); cf. [William Berriman], *A Seasonable Review of Mr. Whiston's Account of Primitive Doxologies* (London, 1719); Glocester Ridley, *The Good Christian Never Dies. A Sermon preached in the Parish Church of St. Andrew Undershaft, at the Funeral of William Berriman* (London, 1750). Berriman nevertheless shared Newton's belief that the triumphs of contemporary astronomy 'great as they are, and prodigiously improved by an inimitable genius of our own nation' represented a revival of Pythagorean, Egyptian, and Patriarchal knowledge: see *Human Learning recommended from the Example of Moses* (London, 1727), p. 7.

[46] Joseph Trapp, *The Doctrine of the Most Holy, and Ever-Blessed Trinity, Briefly Stated and Proved* (London, 1731), pp. 32–3; cf. Isaac Newton, *The Principia*, trans. I. Bernard Cohen and Anne Whitman assisted by Julia Budenz (Berkeley: University of California Press, 1999), pp. 940–1. See also Stephen D. Snobelen, " 'God of gods and Lord of lords': The Theology of Isaac Newton's General Scholium to the *Principia*," in *Osiris*, 2nd series, 16 (2001), pp. 169–208.

circumscribed, but are infinite, like the *supream Being*, they are distinguished from the *Father*, and we are directed to pray to them and worship them, which is more than some of their Modern Enemies will allow." It is unimportant which of Newton or Bedford had the more inaccurate view of Philo's own beliefs. Bedford had surely identified Newton's attempt in the General Scholium to find appropriate ancient witnesses for his anti-Trinitarian conception of God, which was closely tied to his sense that only God the Father could sensibly be the subject of worship without risking idolatry. Like other Moyer lecturers, and in common with Waterland and his allies more generally, Bedford was therefore setting out historical and textual grounds for rejecting Newton's religion, without prejudice to his reputation as a natural philosopher.[47]

Newton's heirs did not respond directly to the assault on his scholarly probity. Nevertheless, in June 1737, Catherine Conduitt, who as the daughter of Newton's step-sister had inherited his papers along with her husband, John, added a codicil to her will that indicated that further publications were being entertained, including the printing of the letters on *Two Notable Corruptions of Scripture*. She named a controversial divine, Arthur Ashley Sykes, as a possible editor for Newton's papers. In 1744, Sykes did print an extensive vindication of Newton's *Chronology*, in which he defended Newton's "very great Sagacity in adjusting and reconciling the fabulous Stories of the Antients" against the criticism of William Warburton, but he appears not to have settled down to consider Newton's unpublished papers until the autumn of 1755, shortly before his death.[48] As a result, nothing came of this attempt to put Newton's side of the argument in a clearer way.

Nevertheless, Newton's reputation as an author who favoured orthodox Christian belief grew during the eighteenth century largely as a result of three factors. The first was the steadfast maintenance of the story of Newton's own simple piety by friends like William Stukeley. This concealed the fact that Newton was only an occasional conformist for whom attendance at the worship of the Church of England was made considerably easier during his later years by life in Samuel Clarke's parish, where accommodations in the

[47] Arthur Bedford, *Eight Sermons preached at the Cathedral-Church of St. Paul, in the City of London, in Defence of the Trinity, and the Incarnation of the Son of God, from the Testimony of the Most Ancient Jews* (London, 1741), pp. 76–86, quotations at pp. 76, 78–9; cf. Newton, *The Principia*, trans. Cohen, Whitman, and Budenz, pp. 941–2. See also Rudolf De Smet and Karin Verelst, "Newton's Scholium Generale: The Platonic and Stoic Legacy — Philo, Justus Lipsius and the Cambridge Platonists," in *History of Science*, 39 (2001), pp. 1–30.

[48] New College, Oxford, MS 361.4, fol. 139; Arthur Ashley Sykes, *An Examination of Mr. Warburton's Account of the Conduct of the Antient Legislators* (London, 1744), pp. 222–364, quotation at p. 223; cf. William Warburton, *The Divine Legation of Moses Demonstrated*, 2 vols (London, 1738–41), 2: 206–81. On this dispute, see Manuel, *Isaac Newton. Historian*, pp. 180–2. See also Rob Iliffe, "A 'connected system'? The Snare of a Beautiful Hand and the Unity of Newton's Archive," in *Archives of the Scientific Revolution*, ed. Michael Hunter (Woodbridge: The Boydell Press, 1998), pp. 137–57, especially pp. 141–3.

public liturgy could be made to ease his tender conscience.[49] Secondly, the general reception of Newton's natural philosophy, as presented by Richard Bentley's Boyle lectures, by Newton's own General Scholium to the *Principia*, and by the published correspondence of Leibniz and Clarke, was that it tended to promote Christianity and support the Church. This was perhaps more a reflection of a belief among Low Church divines that natural philosophy itself might be conducive to religion, and of the popularity of Locke's epistemology, rather than a wholesale endorsement of Newtonianism, but nevertheless it had powerful effects.[50] It was also the way in which the cautious Newton had intended to present his system, apparently shorn of most of its clandestine heterodoxy. Even so, its appearance required the prompting of Bentley in 1692 and the careful direction given to the reader by Roger Cotes's preface to the *Principia* in 1713.[51] Finally, there was the revival in eschatological prophecy in the last two decades of the eighteenth century, in whose vanguard came Unitarian readers of Newton's theology such as Joseph Priestley. This also paved the way for the widespread interest in Newton's *Observations* among nonconformists in the nineteenth century.[52] That movement, however, returned Newton's theological works to controversy rather than saving them from it.

Thus, Samuel Horsley, the High Church editor of Newton's *Opera Omnia* (1779–85), which reprinted the *Chronology* and the *Observations* and provided the first reliable edition of Newton's letters on the corruption of scripture, took Priestley to task: "It is probable too, that after the pains which I have taken to examine the writings and authorities on which [Newton's] ancient chronology was founded, I am as well qualified, as Dr. Priestley, to judge of his talents in . . . subjects, which are not capable of demonstration. Now in these, I scruple not to say . . . that the great Newton went out like a Common Man."[53] For Horsley, as for many other orthodox divines, the printing of Newton's theological works was a way to reveal their inadequacy and thus to snatch away a weapon from anti-Trinitarian critics of the Church. While his unpublished

[49] See William Stukeley, *Memoirs of Sir Isaac Newton's Life*, ed. A. Hastings White (London: Taylor & Francis, 1936), pp. 69–71; Whiston, *Historical Memoirs*, pp. 98–9; Stephen D. Snobelen, "Isaac Newton, heretic: the strategies of a Nicodemite," in *British Journal for the History of Science* 32 (1999), pp. 381–419, especially pp. 396–412.

[50] See John Gascoigne, *Cambridge in the Age of the Enlightenment* (Cambridge: Cambridge University Press, 1989); [Daniel Waterland], *Advice to a Young Student* (London, 1730), pp. 22–8.

[51] *Newton Correspondence*, 3: 233–40; Larry Stewart, "Seeing through the Scholium: Religion and Reading Newton in the Eighteenth Century," in *History of Science* 34 (1996), pp. 123–65.

[52] See Clarke Garrett, *Respectable Folly* (Baltimore: Johns Hopkins University Press, 1975); John Arthur Oddy, "Eschatological Prophecy in the English Theological Tradition c. 1700–c. 1840," unpublished Ph.D. thesis, London University, 1982; David S. Katz and Richard H. Popkin, *Messianic Revolution. Radical Religious Politics to the End of the Second Millennium* (London: Allen Lane, 1999), pp. 107–204.

[53] [Samuel Horsley], *Remarks upon Dr. Priestley's Second Letters to the Archdeacon of St. Alban's* (London, 1786), p. 20; cf. F. C. Mather, *High Church Prophet* (Oxford: Clarendon Press, 1992), pp. 45–8, 55–60.

notes on Newton's *Chronology* show respect for some of the corrections to historical dating that were made there, Horsley rejected Newton's fundamental reordering of Egyptian regnal dates and attacked his tendency to credit tendentious opinions without mention of more orthodox alternatives: "for the sake of doing credit to the Arian Doctrine by representing it as the oldest Christianity."[54] Some clerical authors felt it was acceptable to praise the style of Newton's interpretation of prophecy, but few argued for the validity of the resulting chronology. George Bingham, rector of Pimperne, Dorset, for example, who was sympathetic to the premillenarian interpretation of prophecy set out by Newton, nevertheless suggested that "Sir Isaac Newton has many notions which even his authority can never recommend" and that "this great man confounds distinct periods, & died before he had revised his work."[55]

The inclusion in Horsley's edition of some of Newton's theological works, in particular his reprinting of Newton's letters on *Two Notable Corruptions of Scripture*, eventually gave a new lease of life to discussions of Newton's divinity among more orthodox divines. Horsley took the text of the discussion of I John 5:7 and I Timothy 3:16 from Newton's own drafts, to which he had access among the papers of Jeffery Ekins, Dean of Carlisle, who had obtained them after Sykes's death. Several of those who were later disturbed by the publication of Newton's opinions beat a path to the door of Ekins's heirs, for example the great Scottish Presbyterian minister, Thomas Chalmers, who examined some of the relevant manuscripts in September 1833. Rather later than this, Newton's first serious biographer, Sir David Brewster, corresponded with members of the Ekins family about the use of the manuscripts in their possession. Brewster had initially tended to view Newton as a pious and orthodox Christian, before realising that "it is now quite certain that Sir Isaac was a *semi-Arian* in his religious opinions, as had been long conjectured from his account of the two corruptions of Scripture."[56] The position that Brewster took in 1855 was quite different from his earlier view that "I regret deeply that any thing which I have said in my Life of Newton should be considered injurious to his Memory, or calculated to affect the interests of sound religion."[57] Despite his intentions, therefore, the work of Horsley finally came to threaten the consensus about the irrelevance of Newton's biblical criticism, but the effects of this did not really become apparent until the

[54] Royal Society, London, MS 544, item 8, p. 4.

[55] George Bingham, *Dissertations, Essays, and Sermons*, ed. Peregrine Bingham, 2 vols (London, 1804), 1: 267; [George Bingham], *Τα χιλια ετη. A Dissertation on the Millennium* (London, 1772), manuscript additions by the author, facing p. 27 [library of All Souls College, Oxford, shelfmark X. 5. 18]; cf. the more extravagant praise of Newton's interpretation of the style of biblical prophecy in George Burton, *An Essay towards the Reconciling the Numbers of Daniel and St. John* (Norwich, 1766), which was devoted to proving the prophetic significance of the year 1764.

[56] New College, Oxford, MS 361.4, fols 141–151, 157–81 (quotation at fol. 178v).

[57] Brewster to Thomas Burgess, 5 December 1831, Bodleian Library, Oxford, MS Eng. Lett. c.133, fols 133–5.

mid-nineteenth century, once Unitarian critics had begun to claim Newton's beliefs as an argument for the validity of their own faith.[58]

Even so, it was unnecessary for eighteenth-century critics of Newton's theology to take refuge in the natural philosophy and scriptural exegesis of John Hutchinson, whose tenets seemed laughable to those, like Arthur Bedford, who had a competent knowledge of Hebrew. The Hutchinsonians, in any case, were more concerned with overthrowing Newton's natural philosophy than with bothering about his divinity and their arguments in favour of the Trinity were often less than incisive.[59] For many of Newton's readers, however, the principal attraction of his writings both in natural philosophy and theology lay in their anti-Trinitarianism. These included several leading figures in the Church of England, notably Edmund Law, Bishop of Carlisle, and his allies who themselves had doubts about the doctrine of the Trinity and for whom Newton's letters on *Two Notable Corruptions of Scripture*, which "surreptitiously got into Print" in 1754, proved irresistible ammunition in the campaign to institute a fresh translation of the Bible as part of the doctrinal improvement of the Church.[60]

Yet neither Newton nor Clarke ever risked their careers for such a reformation of the Church. According to Whiston, who was himself less cautious, the reason for this was that they believed that the prophecy of Daniel's seventy weeks remained unfulfilled: "However, it is not impossible that such a Notion of a long future corrupt State of the Church soon coming on, according to the Scripture Prophecies, might be one Discouragement to Sir *Isaac Newton*'s and Dr. *Clarke*'s making publick Attempts for the Restoration of Primitive Christianity: as I confess my Expectation of the near approach of the Conclusion of the corrupt State, and by Consequence of the Commencement of the State when Primitive Christianity is, by those Prophecies, to be restored, greatly encourages me to labour for its Restoration."[61]

The reticence that led Newton to keep secret his views about the doctrine of the Trinity indeed did not derive principally from anxiety concerning publication of his ideas about the two notable corruptions of scripture. Other more orthodox critics also doubted the authenticity of the verses examined by Newton. Thus John Mill, to whose massive attempt to gather up variant readings of the text of the New Testament Newton had himself contributed

[58] Henry Acton, *Religious opinions and example of Milton, Locke and Newton* (London, 1833).

[59] For example, George Horne, *A Fair, Candid, and Impartial State of the Case between Sir Isaac Newton and Mr. Hutchinson* (Oxford, 1753); Bristol Central Library, MS B 26063, correspondence of A. S. Catcott and John Hutchinson, letter 2; cf. Wiltshire Record Office, MS 1178/631.

[60] See Law's annotations interleaved in a copy of the *Geneva Bible* (London, 1606) [BL, C.45.g.13], especially vol. 3, facing sig. Mmm5v; Young, *Religion and Enlightenment*, pp. 45–119. The quotation about the publication of Newton's letters on *Two Notable Corruptions of Scripture* comes from a letter from Jeffery Ekins to Joseph Wilcox, 27 March 1757, New College, Oxford, MS 361.4, fol. 141r-v.

[61] Whiston, *Historical Memoirs*, p. 157.

during the 1690s, noted the paucity of authentic manuscript witnesses to I John 5:7 and rehearsed more briefly the problems associated with I Timothy 3:16.[62] Richard Bentley, who perhaps knew of Newton's discussion of I John 5:7, also questioned the authenticity of the received reading of that verse without casting doubt on the doctrine of the Trinity that it underpinned: "Arianism in its height was beat down without the help of that verse: and, let the *fact* prove as it will, the *doctrine* [of the Trinity] is unshaken."[63] Newton's concerns arose from the fact that for him the corruption of the text of the Bible was one aspect of a much broader perversion of the Christian religion, perpetrated by Athanasius and his followers in the fourth century.

For Newton, the notion of the divine Trinity represented the culmination of the human tendency to corrupt religion into idolatry. The survival of the true Church depended on the correct understanding of God, who ruled through his servants with undivided dominion over the created world, and its manifestation in an appropriate form of worship.[64] The burden of the prophecy of the seventy weeks might have forced Newton to intervene publicly in debate about the doctrines of the Church at two moments, in 1687–91 and in 1709–13. These were both times of tribulation for God's people when it seemed that the captivity of the Church might begin again.[65] In 1687, Newton broke cover to defend the legality of the University of Cambridge's refusal to admit the Benedictine monk, Alban Francis, to an MA without taking the oaths. This was Newton's first public act of defiance to the regime of James II and its policy of advancing the rights of Catholics. Following James's deposition in 1688, Newton took up a university seat in the Convention Parliament, which considered not only the succession but the right of the Church of England to persecute dissenters. Less than nine months after the dissolution of the Convention, when fears were already mounting about the religious and theological disorder that might result from the Toleration Act that it had passed, Newton sent the first of his letters to Locke about two notable corruptions of scripture, I John 5:7 and I Timothy 3:16. For a brief few months, Newton dared to think of allowing Locke's friend, Jean Le Clerc, to publish a Latin or French translation of the work, before retreating under the mounting anxieties of the time.[66]

[62] '*Η Καινή Διαθήκη. Novum Testamentum cum lectionibus variantibus*, ed. John Mill, (Oxford, 1707), pp. 624, 738–49; *Newton Correspondence*, 3: 289–90, 303–4, 305–8 (Newton's "Specilegia Variantium lectionum in Apocalypsi," whose whereabouts are described as unknown (p. 308), may be found at The Queen's College, Oxford, MS 326, fols 2r–4v).

[63] *The Correspondence of Richard Bentley, D. D.*, ed. Christopher Wordsworth, 2 vols (London, 1842), 2: 530; cf. Whiston, *Historical Memoirs*, p. 101.

[64] Yah. MSS 14, fols 25, 173; 15.5, fol. 90r; cf. Newton, *The Principia*, trans. Cohen, Whitman, and Budenz, pp. 940–1.

[65] Cf. Yah. MS 10.2, especially fol. 14v.

[66] Jean Le Clerc, *Epistolario*, ed. Maria Grazia and Mario Sina, 4 vols (Florence: Olschki, 1987–97), 2: 50–2; for Le Clerc's place in the circulation of critical ideas about the text of the Bible, see Maria-Cristina

Le Clerc's copy of Newton's work, written in Locke's hand, was never returned. Le Clerc cited it anonymously in his contribution to Ludolf Küster's edition of Mill's work on the Greek New Testament, published at Rotterdam in 1710. Versions of it also circulated after Le Clerc's death in 1736, by which time the manuscript was incomplete.[67] One of these later became the basis for the first, inaccurate publication of the letters in 1754.[68] By then, reference to Newton's conclusions had been incorporated into John James Wettstein's great critical edition of the Greek New Testament, published between 1751 and 1752. This work was notable for its judgements about many of the manuscripts whose authority had been cited by earlier critics for establishing the text of the New Testament. Wettstein obtained information from a number of English informants, including those with Arian leanings, such as John Jackson of Leicester.[69] His distant cousin, Caspar Wettstein, who was librarian to the Princess of Wales, assisted in the search for manuscripts and spent some of his time trying to ferret out a complete text of Newton's letters on the corruption of scripture, which for over a decade he had known might be found in the possession of the Conduitt family.[70] Although the efforts of the Wettsteins may have been linked to Catherine Conduitt's decision to approach Sykes to edit some of Newton's unpublished papers, they did not succeed in making public a complete version of the *Two Notable Corruptions of Scripture*.

Overt critics of Newton's work were also alert to the possibilities provided by Le Clerc's copy in Amsterdam and their actions may have influenced the fate of plans for the publication of the letters. Thus John Berriman, brother of William, on hearing of the manuscript from a merchant in London in 1738, procured a copy of part of Newton's text via an intermediary in Amsterdam, from which he took a second copy that he deposited in the library at Sion College,

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Pitassi, "La notion de communication dans l'exégèse biblique de la fin du XVIIe siècle," in *Commercium litterarium, 1600–1750*, ed. Hans Bots and Françoise Waquet (Amsterdam: APA-Holland University Press, 1994), pp. 35–50.

[67] Leicestershire Record Office, Conant MSS., Barker correspondence, vol. 2, letter 123A (Samuel Crell to William Whiston, 28 September 1736); a copy made from Crell's copy of the manuscript survives at Bibliotheek der Rijksuniversiteit, Leiden, MS Semin. Remonstr. Bibl. 12.

[68] *Two Letters of Sir Isaac Newton to Mr. Le Clerc* (London, 1754), pp. 13–14, recording that "the four first paragraphs of the Manuscript are lost."

[69] On Wettstein, see C. L. Hulbert-Powell, *John James Wettstein 1693–1754* (London: Society for Promoting Christian Knowledge [1938]); see also the references to Newton in Wettstein's edition of the *Greek New Testament*, 2 vols (Amsterdam, 1751–2), 1: 185; 2: 335. For his contacts with Jackson and others, see Bibliotheek van de Universiteit, Amsterdam, MSS A 158 and Q 97. Wettstein had preached Le Clerc's funeral sermon and his relative, James Wettstein, had overseen the sale of Le Clerc's books, see *Catalogus librorum. . . tum manuscriptorum. Doctissimi atque clarissimi viri Joannis Clerici* (Amsterdam, 1735). Wettstein may also have been responsible for placing Le Clerc's copy of Newton's letters to Locke in the library of the Remonstrant Seminary in Amsterdam, see Sir David Brewster, *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton*, 2 vols (Edinburgh, 1855), 2: 338.

[70] BL, MS Add. 32,415, fol. 388, Hopton Haynes to Rev. John Caspar Wettstein, 17 August 1736. Cf. Bibliotheek van de Universiteit, Amsterdam, Mss A 168 (especially A 168(a), which mentions the search for a complete text of Newton's letters in March 1752), A 170, and J 97 (letters to J. J. Wettstein from England, 1748–1752).

London. The information that he gathered in this way was used to identify Newton's authorship of certain arguments more precisely and deployed in further attacks on his scholarship, in particular on his reliance on inaccurate Latin translations of Greek sources.[71]

There had also been a second occasion when Newton had considered publishing his letters to Locke. In around 1709, he commissioned Hopton Haynes, an employee at the Mint who shared his anti-Trinitarian sentiments, to translate what he had written about 1 John 5:7 into Latin. The manuscript title-page of this work bore the putative imprint "Amsterdam. 1709."[72] The years around the end of the first decade of the eighteenth century were difficult ones for Newton and his closest disciples. After the Tory election victory of 1710, the liberties that had been won for religious dissenters in 1689 seemed to be under increasing threat. Moreover, from 1708, Whiston began to draw attention to himself as a critic of the orthodox doctrine of the Trinity and a proponent of further reformation in the Church.[73] Whiston attempted to involve both Samuel Clarke and Newton in the debate that he conducted with Archbishops Tenison and Sharp and Bishop Lloyd during 1708 and 1709.[74] It seems likely that this exchange prompted Newton to reconsider the publication of his letters on the scriptural authority for the doctrine of the Trinity. Haynes later remarked of his translation that "I know S^r Isaac intended them for the Press, and only waited for a good opportunity."[75] Yet Newton hesistated. Both Whiston and Clarke knew of Newton's attack on the authenticity of 1 John 5:7 by 1719.[76] But although Whiston had obtained a copy of the letters by 1738, it seems unlikely that he had extensive physical evidence of Newton's beliefs during his mentor's lifetime.[77] John Berriman claimed that Whiston had told him that Haynes's translations would have been printed "if he had

[71] John Berriman, *θεὸς ἐφανερώθη ἐν σαρκὶ. Or, a Critical Dissertation upon I Tim. iii. 16* (London, 1741). This book was the printed version of Berriman's Moyer lectures, delivered in 1737–8. A copy now in the British Library [shelfmark 1017 k. 17] has manuscript notes by Berriman, probably composed in 1761, which include the additional information about Newton's letters (at pp. 167–8). Berriman wrote up an account of his discovery in the transcription of Newton's "dissertation on I Tim. 3. 16" that he deposited at Sion College Library, London: MS ARC L 40.2/E 39, fol. 1r–v. He named the merchant as Peter Dobree and his intermediary as Rev. John Kippax. Elsewhere Berriman suggested that Wettstein had assisted Kippax while he was in Amsterdam: see his letters to J.J. Wettstein, 26 March and 20 July 1741, Öffentliche Bibliothek der Universität Basel, MS Ki. Ar. 154, numbers 6–7. It may have been Daniel Waterland who communicated queries that were based on Berriman's work to another of his clients, John Mawer (see [Mawer], *Letters in Answer to Some Queries sent to the Author, concerning the Genuine Reading of the Greek Text, I Tim. iii. 16. . . Now First Published on Occasion of Sir Isaac Newton's Two Letters to Mr. Le Clerc* (York, 1758).

[72] Yah. MS 20.

[73] BL, MS Add. 24,197; Gloucestershire Record Office, Lloyd-Baker Mss [D 3549], box 74, bundle 9; Northamptonshire Record Office, Finch-Hatton Mss 2623-5.

[74] Whiston, *Historical Memoirs*, pp. 15–17.

[75] BL, MS Add. 32, 415, fol. 388.

[76] Whiston, *Historical Memoirs*, p. 100.

[77] Whiston, *Memoirs*, 1: 365, which refers explicitly to the letter on I Timothy 3:16 alone; see also Isaac Newton, *Ecrits sur la religion*, ed. Jean-François Baillon (Paris: Gallimard, 1996), pp. 21–2.

not blabb'd it out, [that Sir] Isaac was [the] Author of [them]."[78] Newton did reveal hints of his heterodox ideas about God in the General Scholium that he added to the second edition of the *Principia* in 1713, in the process supporting Clarke's arguments, published in *The Scripture-Doctrine of the Trinity* during the preceding year.[79] Controversial though Newton's published views were, they stopped short of spelling out the implications for the Church of his beliefs about the nature of God.[80] Newton therefore chose to keep his own counsel about the past and future of true religion, despite the dangers that confronted his friends and the threat of a return to the persecution of dissent. Curiously, the exposure of his genuine opinions was thus left to the divines of the eighteenth-century Church of England. Their rhetorical and intellectual triumph over the arguments favourable to Arianism in Newton's published works effectively consigned his treatment of the historical development of the doctrine of the Trinity to the margins of debate.

The extent of the failure of Newton's published writings and of the pronouncements of his followers to sustain belief in the seriousness and implications of his heterodoxy can be gauged from some early nineteenth-century comment on Newton's treatment of the *Two Notable Corruptions of Scripture*. In the context of the debate following the Unitarian Toleration Act of 1813, which repealed the restrictions that had been incorporated into the legislation of the late seventeenth century, a number of churchmen discussed the question of Newton's attitude to orthodox doctrine. Dr. Routh, then a mere twenty-three years into his sixty-three year reign as President of Magdalen College, Oxford, argued that it was "probable, that [Sir] Isaac Newton has not expressed his disbelief of the Trinity in his Letter to Le Clerc . . . and . . . I think it very unlikely, he would commit himself on this head."[81] Henry Phillpotts, Prebendary of Durham, dismissed the information about Newton's heresy to be found in the writings and memoirs of William Whiston as "suspicious evidence, which cannot now be enquired into, as it rests solely on the affirmation of parties long since dead" and denied the validity of the "hearsay testimony" by which Unitarian writers from the late eighteenth-century had attempted to co-opt Newton to their cause.[82]

Thomas Burgess, Bishop of St David's and later Bishop of Salisbury, was especially keen on the argument that Newton's failure to publish his letters on the *Two Notable Corruptions of Scripture* implied that he had had doubts about the implications of his case concerning the biblical foundations of the

[78] Sion College Library, London, Ms. ARC L 40.2/E 39, fol. 1v.

[79] Stewart, "Seeing through the Scholium."

[80] See Newton, *The Principia*, trans. Cohen, Whitman, and Budenz, pp. 940–1.

[81] M.J. Routh to Thomas Burgess, 6 October 1814, Bodleian Library, Oxford, MS Eng. Lett. c.138, fols. 35–6.

[82] Phillpotts to Thomas Burgess, 24 February 1816, Bodleian Library, Oxford, MS Eng. Lett. c.138, fols. 5–6.

doctrine of the Trinity.[83] Without the testimony of Brewster and the evidence from Newton's manuscripts that he uncovered, it thus remained possible to pretend that "if the Unitarians have no other proof of that great man's being on their side of the question than his having once doubted the authenticity of a text, supposed to support or declare the doctrine of the Trinity, the expression of which doubts he afterwards suppressed, they are not entitled to reckon him amongst their number."[84]

For over a hundred years, therefore, the defenders of the doctrine of the Trinity managed to limit the effects of Newton's criticism through a successful combination of scholarship and ridicule. Their actions, together with his own reticence, made it plausible to regard Newton's doubts about the doctrine of the Trinity as an irrelevant or misguided sideshow to his achievements in natural philosophy and natural theology. The fragmentation of ideas that resulted from the failure to publish clear statements of Newton's theology before 1727 was exploited after his death. Beliefs that Newton had held were recast, either as dangerous and partisan interpretations of his work, or as the errors and delusions of a near-senile mind. Newtonian natural philosophy was sanitised to become a weapon that could from time to time be deployed by the Church in its own natural theological attacks on sceptics or freethinkers.[85] Newton's name was thus co-opted for causes that were only partly his own and protected as far as possible from abuse by heterodox writers. As part of that process, the more shocking of Newton's ideas were subjected to sustained criticism from orthodox churchmen. Newton's published anti-Trinitarian writings were discredited so efficiently that it became hard for late eighteenth- and early nineteenth-century commentators to believe that the great mathematician and natural philosopher could really have written them. When his authorship was established, they wondered instead whether he could really have meant what he seemed to say. Daniel Waterland and his allies had performed the task of answering Newton remarkably well.

[83] Thomas Burgess, *Remarks on the General Tenour of the New Testament, Regarding the Nature and Dignity of Jesus Christ* (Salisbury, 1831), which carried an appendix concerning 'Sir Isaac Newton's suppression of his dissertation' on I John 5:7 and I Timothy 3:16. Several correspondents of Burgess did, however, try to convince him of the sincerity of Newton's opinions, see for example Samuel Vince to Burgess, 7 October 1814, Bodleian Library, Oxford, MS Eng. Lett. c.139, fol. 7r–v. Vince also drew attention to the existence of Newton's unpublished papers. Burgess's own copy of Horsley's edition of Newton's *Opera quae exstant omnia*, 5 vols (London, 1779–85), however, bears evidence of his search in the text of Newton's letters on the *Two Notable Corruptions of Scripture* for signs of equivocation: University of Wales, St. David's College, Lampeter, Founder's Library, shelfmark 34 D, vol. 5, especially pp. 497–9.

[84] Joanna Baillie to Thomas Burgess, 24 December 1831, Bodleian Library, Oxford, MS Eng. Lett. c.133, fols 24–5; cf. the correspondence of Brewster and Burgess, fols 133–5.

[85] See Gascoigne, *Cambridge in the Age of the Enlightenment*, pp. 142–84.

ESSAY 7

Prosecuting Athanasius: Protestant Forensics and the Mirrors of Persecution

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Isaac Newton has traditionally been revered as a great natural philosopher and mathematician. More recently, he has been uncovered as an adept alchemist and theologian. Less well known is the fact that, in addition to these accomplishments, he was also a legal expert, an historical litigator who used any evidence at his disposal to indict historical malefactors for their crimes. With regard to his scientific work, this fact would be of minimal relevance except that Newton was occasionally called upon to defend his originality, priority, and all-round superiority over enemies such as Robert Hooke, Gottfried Leibniz, and the Jesuit critics of his theory of light and colours. Historians, most notably Frank Manuel, have argued that, under pressure, Newton's uncompromising treatment of his competitors resulted from a psyche ruined by a tough, and perhaps unloving, Puritan upbringing. When provoked by the less than adulatory attitudes of his addersanes, Newton's behaviour usually manifested itself in a detailed and emotional investigation of the way his enemies had been fraudulent and generally immoral. Newton was doubtless in possession of a dysfunctional personality but the analysis in this paper suggests that his destructive, litigious modes of attack owe their structure to the standard exegetical techniques deployed privately in his investigations of the early Church. At the same time, his experiences of success and failure in the late seventeenth century undoubtedly informed his understanding of the political and religious controversies of the fourth century.[1]

[1] See Frank Manuel, *A Portrait of Isaac Newton* (Cambridge, Mass: Belknap Press of Harvard University Press, 1968), chaps. 1, 7, 11, and 15. I would like to thank Moti Feingold, Justin Champion, Jim Force and Mats Fridlund for comments on earlier versions of this paper.

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 113–154.
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While Newton lived and worked in a contemplative setting ostensibly far removed from the political ferment of Restoration England, college life was by no means divorced from the external events that unfolded in the reigns of Charles II and James II. Although he was situated in the ivory tower of Trinity College, Cambridge, he was aware on a daily basis of the ways in which the Restoration Established Church was reinforcing many of the older forms of doctrine and worship. In September 1660, for example, John Ray described the return to Trinity of the master, Henry Ferne, and a number of fellows as the "old gang" who had returned everything to the situation as it was in 1641, "viz., services morning and evening, surplices Sundayes and holydays, and their eves, bowing, going bare and fasting nights." A year after Ray departed the college in 1662, John Pearson became Master of Trinity, a post he would hold for nearly a decade. He urged that postgraduate students rigorously study patristic literature and stressed the significance of the earliest writers in his influential *Exposition of the Creed* of 1659. Beyond the local political environment at Trinity, theological texts provided an equally rich source for Newton's awareness of politico-religious issues and he was well briefed to examine early Church controversies in the editions of the ecclesiastical historians.[2]

Individuals of all religious persuasions agreed that a good way to understand contemporary English politics lay in a proper reading of the political events and doctrinal disputes of the fourth century. More than any period except the times of Christ himself, the gradual instantiation of Christianity as the state religion (from the conversion of Constantine in 312 to the acceptance of the Athanasian Creed as orthodoxy at Constantinople in 381) served as a focus for early modern concerns over the relationship between church and state. In the light of what had taken place in the early Church, and considering the terrible events of the civil wars and Interregnum, what was the proper connection supposed to be between the Restoration monarchy and the Anglican Church? What, indeed, was to be the proper field of the established religion—that is, what sorts of believers and practices were to be comprehended or embraced under the heading of Anglicanism? To what extent if at all should the state church 'tolerate' those outside its swallow? What punishments should be meted out on those that refused to conform to Anglican rituals and how far could the head of that Church go in this direction before he or she became a rank persecutor? From the opposite side, what sort of moral, religious, or political obligation was there on nonconformists to publicly worship according to the established Church? Was it hypocritical to publicly profess the state religion while keeping one's real religious beliefs private? The rich body of

[2] R. W. T. Gunther, *The Further Correspondence of John Ray* (London, 1928), p. 17. For Cambridge reforms in the wake of the Restoration, see J. Gascoigne, *Cambridge in the Age of Enlightenment: Science, Religion and Politics from the Restoration to the French Revolution* (Cambridge: Cambridge University Press, 1989), pp. 27–50.

textual matter that had been preserved from the fourth century—evidence that was badly tainted according to the unorthodox—provided a rich resource for understanding the nature and origin of orthodox trinitarian Christianity for both Anglican and Roman Catholic apologists as well as for assessing the proper demeanour of the individual sovereign.[3]

In the reign of Charles II, Anglican controversialists generally made their reputations by assailing either the idolatry of Catholicism or the ungratefully schismatic tendencies of dissenters. Although anti-Trinitarians and their doctrines were resisted in the 1640s and 50s by orthodox Anglicans, and indeed by nonconformist Calvinists such as John Owen, it was not the central topic of concern until the reign of the Catholic king, James II. The great controversies over the status of the Godhead were unleashed by James's Declaration of Indulgence in early 1687 after which his subjects were freer than they had been for more than three decades to express their religious opinions in worship and print. This liberty spawned the acres of print devoted to the nature of the Trinity, the status of Scripture and the history of the Church that provide the background to Newton's own attack on the orthodox accounts of fourth-century controversies. While there has been a great deal of scholarly interest in the theological issues that were debated in this decade following the Declaration, there has been little detailed analysis of the early modern *historical* accounts of the personages and events involved in the early Church disputes.[4]

As a context in which to examine Newton's own analysis of the early church, I examine two orthodox Restoration histories of the life and actions of Athanasius in which Athanasius is held up as the heroic formulator and guardian of orthodox Christianity. As the title suggests, Newton's "Paradoxical Questions concerning the Morals and Actions of Athanasius and his

[3] For the Restoration Church of England, see I. M. Green, *The Re-establishment of the Church of England, 1660–1663* (Oxford: Oxford University Press, 1978) and J. Spurr, The *Restoration Church of England, 1646–1689* (New Haven: Yale University Press, 1991) For general works and collections on persecution and toleration in the early modern period, see W. K. Jordan, *The Development of Religious Toleration in England*, 4 vols (London: Allen & Unwin, 1932–40); O. Grell, J. Israel, and N. Tyacke, eds, *From Persecution to Toleration* (Oxford: Oxford University Press, 1989); O. Grell and R. Scribner, eds, *Tolerance and Intolerance in The European Reformation* (Cambridge: Cambridge University Press, 1996); J. C. Laursen and C. J. Nederman, eds, *Beyond the Persecuting Society: Religious Toleration before the Enlightenment* (Philadelphia: University of Pennsylvania Press, 1997); J. Coffey, *Persecution and Toleration in Protestant England, 1558–1689* (Harlow: Pearson, 2000)

[4] Throughout this paper, I use the term antitrinitarian although the modern term, Unitarian, was widely used to describe antitrinitarian positions beginning in the late 1680s. For general histories of antitrinitarian writings and the treatment of antitrinitarians, see R. Wallace, *Antitrinitarian Biography*, 3 vols (London, 1850); J. H. Colligan, *The Arian Movement in England* (Manchester: Manchester University Press, 1913); H. J. McLachlan, *Socinianism in Seventeenth-Century England* (Oxford: Oxford University Press, 1951); E. M. Wilbur, *A History of Unitarianism*, 2 vols. (Cambridge, MASS: Harvard University Press, 1945–52), vol. 1, *Socinianism and its Antecedents*; G.H. Williams, *The Radical Reformation*, 2nd ed., (Kirksville, MO: Sixteenth Century Journal Publishers, 1992)

Followers," probably written in the 1690s, was a sustained attack on such histories. Newton wrote as a committed antitrinitarian who believed that the Established (trinitarian) Church should tolerate those, such as Newton himself, who dissented from this orthodox doctrine. As it happened, the Restoration Anglican establishment did not accept the anti-Trinitarian heresy and the fact that they were pariahs, at least as unwelcome as atheists or Catholics, was reinforced by the so-called Toleration (1689) and Blasphemy (1698) Acts. However, for Newton, any state that persecuted harmless (i.e. non-seditious) strands of faith within its own confines showed itself to be un- or even anti-Christian; such an approach was likely to extirpate followers of the true faith. Secondly, Newton's view that state religions were for the maintenance of civil and ecclesiastical order, and were not relevant to private religious conscience, underpin his treatment of the fourth century controversies. Nobody—and certainly not the civil magistrate—could really know the inner beliefs of another person and, as a consequence it was absurd, as much as unchristian, to persecute individuals for their private religious views. Finally, Newton took standard Protestant histories and their exegetical techniques, and turned them in on orthodox Protestantism itself. He argued that Athanasius had devised orthodox history for his own self-serving purposes long after the central events between the Council of Nicæa in 325 and his own deposition at the Council of Tyre in 335. However, detailed forensic examination of the period and of the central texts of the time showed that there was no reference to the appalling events Athanasius described when there should have been. This methodology was standard Protestant evidence-from-absence exegesis for detecting apparent Catholic frauds but Newton was not afraid to draw from Roman Catholic histories and apologetics when it suited him.[5]

The Threat of Anti-Trinitarianism

Seventeenth-century antitrinitarian writings could take many forms and individual writers invariably drew from different strands in attacking orthodox positions. For example, one could show by an analysis of Scripture that various pro-trinitarian texts were either absurd or interpolations that did not exist in the earliest Greek manuscripts of the New Testament. This was especially relevant in the wake of Richard Simon's wide-ranging analysis of ancient Biblical manuscripts in the late 1670s and 1680s. Often allied to this sort of analysis was a propensity for antitrinitarian writers to present a minimalist credal formulation that they claimed had been induced from the unprejudiced

[5] See Rob Iliffe, *Priest of Nature: The Private Heresies of Isaac Newton* (New Haven: Yale University Press, 2005) and S. Snobelen, "Isaac Newton, Heretic: The Strategies of a Nicodemite," *British Journal for the History of Science* 32 (1999), pp. 381–419. For Locke's contemporaneous views on toleration and on the extent to which the Established Church could impose religious beliefs, see J. Marshall, *John Locke: Resistance, Religion and Responsibility* (Cambridge: Cambridge University Press, 1994), chaps 7–9.

examination of Scripture. In the political turmoil of England in the 1640s, an unprecedented opportunity arose to promulgate these views and orthodox writers assailed the rise of the subordinationist heresy that owed its rise to the writings of Faustus Socinus. Although many of the anti-Trinitarian writers were not strictly Socinians, the general label was attached by orthodox writers to anyone who overly downgraded the status of Christ or who allowed too much sway to human reason in interpreting Scripture. Doctrinally, Socinians denied the existence of Christ before his incarnation and held that he had been exalted to the right hand of God and made worthy of worship because he had deliberately humbled himself and died on the Cross. His role in human redemption was derived from his exemplary moral behaviour. Equally abhorrent doctrines, held by most anti-Trinitarians, included the denial of predestination (and of eternal torment), of justification by faith alone, of original sin, and of the resurrection of the body. As a consequence of their vision of a godly state in which views like theirs could be allowed to exist, if not thrive, virtually all antitrinitarian writers—Socinian or otherwise—called for a state and/or church policy that precluded the persecution of individuals for their *religious* beliefs.[6]

Across Europe, anti-Trinitarianism was detested in protestant states as much as Anabaptism or popery. In England, freedom of worship for deniers of the Trinity was not available to individuals at any point in the seventeenth century and the state officially sanctioned their persecution. In 1646, John Biddle denied the divinity of the Holy Spirit before parliament and was placed under arrest for five years. Nevertheless, he managed to produce a number of works that covered issues such as the basic creed deducible from Scripture, the doctrine of the Father-Son relationship in the Early Church, and the incomprehensibility and absurdity of the orthodox understanding of the Trinity. Biddle's texts were seminal contributions to the debate in England and were to be significant once more when republished in 1691 at the height of a renewed controversy on the topic. In 1648, however, parliament passed the Blasphemy Act that technically sentenced to death "without benefit of clergy" anyone who promoted (and then failed to repent) antitrinitarian notions. When

[6] See J. Champion, "'Acceptable to Inquisitive Men': Some Simonian Contexts for Newton's Biblical Criticism, 1680–1692," in James E. Force and Richard H. Popkin, eds, *Newton and Religion: Context, Nature, and Influence* (London: Kluwer, 1999), pp. 77–96. For mortalism and Newton's psychopannychism (the doctrine that the soul sleeps after death until God awakens it), see James E. Force, "The God of Abraham and Isaac (Newton)," in James E. Force and Richard H Popkin, eds, *The Books of Nature and Scripture* (London: Kluwer, 1994), pp. 179–200 and, in general, see the classic work by Norman Burns, *Christian Mortalism from Tyndale to Milton* (Cambridge, MASS: Harvard University Press, 1972). For the variety of meanings of "Socinianism," both as a contemporary label and as a doctrine, see G. Reedy, *The Bible and Reason: Anglicans and Scripture in Seventeenth-Century England* (Philadelphia: University of Pennsylvania Press, 1985), pp. 119–26 and, especially, J. Marshall, "Locke, Socinianism, 'Socinianism' and Unitarianism", in M. A. Stewart, ed., *English Philosophy in the Age of Locke* (Oxford: Clarendon Press, 2000), pp. 111–82. For persecution and toleration of antitrinitarians, see Coffey, *Persecution and Toleration*, pp. 52, 99–102, 114–5.

Presbyterians were removed *en masse* from parliament, a second Blasphemy Act reinforcing the previous attitude to antitrinitarianism of all kinds was passed in September 1650.[7]

After the Restoration, when Charles II reasserted the dominant role of the Church of England, dissenters (especially Baptists and Quakers) were liable to severe penalties. Although very few antitrinitarians were persecuted, burning for the heresy of denying the Trinity remained on the statute books as a technical punishment until 1678. More broadly, the stress on the use of reason in private study of the Bible, coupled with an emphasis on *sola scriptura* and exegesis by means of a literal meaning that was accessible to all sane and literate members of the laity, meant that some mainstream Anglican controversialists such as William Chillingworth were denounced as overly Socinian. Moreover, aside from the anti-Trinitarian works that were produced infrequently in Poland and the Netherlands by authors such as Christopher Sand, Jonas Schlichting, Johannes Volkel, and Johann Crell, any text that promoted a radical credal minimalism (and as a consequence, a tolerationist approach) was liable to be condemned as Socinian or antitrinitarian.[8]

Arianism in Restoration England

Although "Socinianism" was the most threatening branch of antitrinitarianism, another form of the heresy had reared its ugly head during the middle of the seventeenth century. This derived from the views of the early fourth century priest Arius, whose opinions are known largely through the three orations against the "Arians" written by their arch-enemy Athanasius. For Arius, the Son was created (and not begotten, as stated in the Nicene Creed) by God *ex nihilo* before and in a different way from all other creatures. Before his incarnation, he was a pre-existent Word or Wisdom of the Father, God's minister on Earth, and the means by which the rest of creation was brought into being. The Son is neither co-eternal, co-essential, nor consubstantial with the Father although he is divine and, indeed, a lesser God. Arius and his immediate

[7] See, inter alia, John Biddle, *Twelve Arguments drawn out of Scripture against the Deity of the Holy Ghost* (London, 1647) and Biddle, *The Faith of One God, Who only is the Father; and of One Mediator between God and Men, Who is only the Man Christ Jesus* (London, 1691.) See Williams, *Radical Reformation,* passing and M. Wiles, *Archetypal Heresy: Arianism through the Centuries* (Oxford: Clarendon Press, 1996), pp. 58–60. For Biddle, see McLachlan, *Socinianism*, pp. 163–212, and, for the "Ordinance of the Lords & Commons assembled in Parliament, for punishing Blasphemies and Heresies, of May 2 1648," see Wilbur, *Unitarianism*, p. 192.

[8] In general, see M. Watts, *The Dissenters: From the Reformation to the French Revolution* (Oxford: Oxford University Press, 1978) and, for persecution in Restoration England, see Coffey, *Persecution and toleration*, chaps. 2 and 7; M. Goldie, "The Theory of Religious Intolerance in Restoration England," in Grell et al., *From Persecution to Toleration* and G. Schochet, "Samuel Parker, Religious Diversity and the Ideology of Persecution," in R. Lund, ed., *The Margins of Orthodoxy: Heterodox Writing and Cultural Response, 1660–1750* (Cambridge: Cambridge University Press, 1995), pp. 119–48.

followers believed that their opinions were to be found in Scripture (especially in the Johannine prologue) and were part of the authentic Christian tradition. They criticized interpreters such as Athanasius who elevated the status and, indeed, substance of Jesus to that of God the Father and termed them "Sabellians" (i.e., those who believed that the persons of the Godhead were modes of one Being.) On the other hand, Athanasius and his supporters charged that Arius allowed so much diversity within the Godhead that he was both guilty of polytheism and—since God alone was the one 'true God' according to the Arians—of idolatry. In addition to being heretical *per se*, Arianism and its variant successors gained a reputation in the early modern period for being incomprehensible and incoherent. For the purposes of this essay, it is important to note that Arian doctrines were preferred by a number of fourth century bishops as well as by the supposedly arch-persecuting Emperors Constantius (337–61) and Valens (364–78.)[9]

Seventeenth-century heresy hunters argued that a revived Arianism was one of the most pernicious perversions that could be imagined although they were not always careful to distinguish it from other anti-Trinitarian positions. As such, the term 'Arian' and 'Arianism' functioned in many works as a general label of abuse as much as did Socinianism. However, scholars also mounted a detailed assault on its tenets. For example, the Cambridge Platonist Ralph Cudworth argued that there was an intimate connection and coherence between the Platonic and Christian trinities. In an effort to distance the former from any quasi-subordinationst doctrine such as Arianism, which was condemned by Cudworth and others for maintaining a creature-God, Cudworth contended that there were no *created hypostases* in the orthodox Platonic variety. Any intimation that either of the second or third hypostases were created from the first was a form of corrupt neo-Platonism. Cudworth did not deny that there were distinctions of status within the Platonic Trinity although he claimed that this was not equivalent to the Arian position. For him, the Nicene formulation of *homoousios* (same or identical essence, nature, or substance) related not to numerical identity but to essence alone. On this showing, the ante-Nicene Fathers were both more Platonized and more faithful to Scripture than was Arius although many of Cudworth's contemporaries, such as Theophilus Gale, argued that the subordinationist elements within the Platonic trinity had led to Arianism.[10]

[9] Wiles, *Archetypal Heresy*, pp. 5–17 and 52–60.

[10] Cudworth, *The True Intellectual System of the Universe* (London, 1678) and Gale, *Court of the Gentiles, pt III, The Vanity of Pagan Philosophy Demonstrated*, (London, 1677). See Wiles, *Archetypal heresy*, pp. 62–9; Sarah Hutton, "The Neoplatonic roots of Arianism: Ralph Cudworth and Theophilus Gale," in Lech Szczucki, ed., *Socinianism and its Role in the Culture of Sixteenth to Seventeenth Centuries* (Warsaw: Polish Academy of Sciences, Institute of Philosophy and Sociology: PWN, Polish Scientific Publisher, 1983), pp. 139–45; and, more generally, W. B. Hunter, C. A. Patrides, and J. H. Adamson, *Bright Essence: Studies in Milton's Theology*, (Salt Lake City: University of Utah Press, 1973.) "Hypostasis" had various meanings in the early Church but it comes from the Greek roots "under" and "standing" or "status." To

While Cudworth's *System* became one of the focal points for historical and doctrinal discussions about the origin of the Trinity and, indeed, for discussing other Platonic elements within the New Testament, the proper relationship between the orthodox Church and state was more readily approached through histories of the early church. Eirenicists cited Constantine the Great's plea just before the Council of Nicæa in 325 that disputing over abstruse issues should not be the cause of a schism in the Church. Others pointed to the need at the end of the fourth century for Theodosius and his successors to impose orthodoxy on a Church that was menaced by heretics, schismatics, and the external power of the Goths. On the whole, orthodox Protestants and Catholics, bound by many similarities in doctrine, believed in a basic story that stressed the wisdom and generosity of Constantine, the man whose conversion to Christianity had resulted in the Roman Empire embracing Christianity as the state religion. Thereafter, the fates of the diabolic and crafty Arius along with his persecutory followers were contrasted with the miraculous survival and final triumph of Athanasius, the great orchestrator of orthodox trinitarian Christianity. Against all odds, the saint had safeguarded the true understanding of the Nicene Creed during the hard years of his banishment and persecution at the hands of the 'Arian' Emperors, Constantius and Valens. Nevertheless, seventeenth-century antitrinitarians believed that this entire history and the basic evidence on which it rested was a pack of lies devised by Athanasius and institutionalized by his corrupt (and largely Catholic) followers.[11]

The Unitarian Controversy

After years of suffering from persecution by the state and the established church, dissenters benefited from a Declaration of Indulgence that was proclaimed on 4 April 1687 by the Catholic king, James II. This proclamation summarily suspended the penal laws and the Test Acts that discriminated against Catholics and dissenters. James admitted that it had proved impossible to "reduce these kingdoms to an exact conformity in religion" while he claimed that "it hath of long time been, our constant sense and opinion (which upon diverse occasions we have declared) that conscience ought not to be constrained, nor people forced into matters of mere religion." In the

refer to a hypostatical unity of the Godhead implied something that was common or substructural to all three elements of the Trinity. For many, this appeared to differentiate inadequately between the parts of the Godhead and, to counter this difficulty, some proffered a notion of three *hypostases* though this view, as we shall see, was held to commit the opposite offence and was susceptible to the accusation of tri-theism.

[11] For fourth century credal formulations, see J. N. D. Kelly, *Early Christian Creeds*, 3rd ed. (Harlow: Longman, 1985), pp. 205–332. For Protestant justifications of persecution, see Coffey, *Persecution and Toleration*, chap. 2, and Goldie, "The Theory of Religious Intolerance in Restoration England." For uses of patristic literature, see D. W. Dockrill, "The Authority of the Fathers in the Great Trinitarian Debates of the Sixteen Nineties," *Studia Patristica* 18 (1990), pp. 335–47, and J-L Quantin, *Le Catholicisme Classique et les Pères de l'Eglise : Un Retour aux Sources (1669–1713*) (Paris: Institut d'études augustiniennes, 1999.)

two years of his reign thus far, Protestants had become suspicious of James's Catholicising practices in the universities, government and army, and worries about a new European Catholic axis had been bolstered by Louis XIV's Revocation of the Edict of Nantes in 1685. Yet although many dissenters distrusted James's goals and non-parliamentary procedures in announcing his aims, the Declaration effectively checked the extent of Anglican power and provided a space to discuss issues of toleration and church doctrine. For anti-Trinitarians, it opened up an opportunity to print pamphlets and books that would last for virtually a decade, spanning the Glorious Revolution until being stifled by the Blasphemy Act of 1698.[12]

Before the Declaration issued by James, there was little in the way of a sustained, printed, antitrinitarian attack on orthodoxy in English. As Wiles points out, this is presumably why George Bull's Latin *Defence of the Nicene Faith* of 1685 was directed at Sand's *Nucleus*. However, one of the first to take advantage of the new publishing opportunity was William Freke (or Frere), who professed to be an "Arrian" in his *Vindication of the Unitarians* of 1687. Freke adopted the conventional anti-Trinitarian pose of claiming that he had become disillusioned with the conventional doctrine of the Trinity after hard study and after making a list of several passages in Scripture, "neither liking giddy Tradition; nor the tricks of wresting several Texts." Freke cited apparently pro-Trinitarian passages to show that the Son was nowhere asserted to be co-equal with the Father while Christ had appeared in the Old Testament as an angel bearing the name of God. Christ had to be an inferior mediator to the Father because his ministerial power had been given to him by a greater being while nowhere in Scripture did it enjoin Christians to worship the Holy Ghost. Finally, having described 1 John 5:7 as unintelligible even if the passage were not itself spurious, Freke rehearsed the standard anti-Trinitarian point that if one professed allegiance to the Trinity one also had to believe in transubstantiation.[13]

Stephen Nye's *Brief History of the Unitarians* made a much larger impact than did Freke's pamphlet. Nye, rector of Little Hormead for four decades until 1719, composed the text in the form of four letters to a "Friend," i.e., Thomas Firmin, sponsor of most of the anti-Trinitarian texts that appeared in the 1690s. Firmin had apparently left the letters with "a Gentleman, a Person of excellent Learning and Worth" (Henry Hedworth) who composed a letter in response to Nye's texts. In his first letter, Nye outlined a history of general antitrinitarian ("Unitarian" or "Socinian") belief, beginning with the Nazarenes, Ebionites,

[12] Coffey, *Persecution and Toleration*, pp. 187–91, esp. 188; J. Miller, "James II and Toleration," in E. Cruickshanks, ed., *By Force or Default? The Revolution of 1688–9* (Edinburgh: Edinburgh University Press, 1989); and S. Trowell, "Unitarian and/or Anglican: The Relationship of Unitarianism to the Church from 1687–98," *Bulletin of the John Rylands Library* 78 (1996), pp. 77–101.

[13] W. Freke, *A Vindication of the Unitarians, against a late Reverend Author on the Trinity* (London, 1687), pp. 1, 11, 12–14, 17, 18, 26–7; Wiles, *Archetypal Heresy*, pp. 66–7.

and others. Nye then described the corruption of authentic Christianity by Trinitarians. The remaining letters discussed texts objected against anti-Trinitarians in the Old and New Testaments and a litany of allegedly pro-Trinitarian passages were then either re-interpreted, so as to make more sense, or rejected as later additions.[14]

In the first letter, Nye affirmed that Christ was "a Man, the Son, Prophet, Messenger, Minister, Servant, and Creature of God; not himself God." Unfortunately, the earliest writings of the Nazarenes, Ebionites, and others—all originally adhering to similar beliefs the socinians were lost, destroyed by the Arians and Catholics, so that evidence from the earliest times was lacking. Nye reported that Socinians believed the "Apostolick Doctrine of one God" survived an attempted persecution by Pope Victor in 194 only to be replaced by the intermediate Arian doctrine in which "*the Father* is indeed before the Son and Holy Spirit, *in Time, in Dignity, and in Power*, yet that *the Word*, or Son . . . was generated or created some time before the World, and was the Father's Servant and Minister in making the World." After Nicæa promoted the doctrine of *homoousios*, orthodox Christians accepted the equality and eternity of the Son and the Holy Spirit with the Father by unity of wills, substance, and nature. It was these later impositions, especially the Athanasian Creed, to which Nye objected and he argued that the original Nazarene, Arian, and Nicene creeds now only thrived in the Netherlands and Transylvania, as well as in some Islamic countries. At the end of the Nye's text, Hedworth responded that the letters proved that "the Doctrine of the *Trinitarians* is no necessary or fundamental Doctrine of Christianity" and that it was "unjust and unchristian, to lay the *Unitarians* or *Socinians* under any Penalties or Forfeitures, upon the account of their Doctrine" and "*Trinitarians* ought to own the *Unitarians* for Christian Brethren, and behave themeselves towards them as such."[15]

Orthodox efforts to counter the antitrinitarian assault received a blow when William III announced in September 1689 that he wished to set up an Ecclesiastical Commission to investigate the possibility of altering the liturgy and canons of the Anglican Church so as to facilitate the comprehension of dissenters. This would then go before the Convocation with the prospect of it being passed as law by parliament. The Athanasian Creed itself came in for hostile scrutiny from some commissioners and Arthur Bury's irenicist *Naked Gospel* was published in 1690 in support of a much simpler credal form. In his short history of the doctrine, Bury – Rector of Exeter College, Oxford –cited

[14] [S. Nye], *A Brief History of the Unitarians, called also Socinians. In Four Letters, Written to a Friend* (London, 1687), pp. 67–8, 137–8, 151–2; Hedworth's letter is on pp. 167–84. See also McLachlan, *Socinianism*, pp. 299–316.

[15] [Nye], *Brief History*, pp. 4–5, 11, 12–13, 26–30, 31–7, and, also, Hedworth's letter on p. 168; See J. Champion, *The Pillars of Priestcraft Shaken: The Church of England and its Enemies, 1660–1720*, (Cambridge: Cambridge University Press, 1992)

Constantine's warning before Nicæa that it was not worth disputing over the nature of the Godhead and argued that belief in the Triune Godhead was not demanded of Christians in the time of Justin Martyr. Theodosius, and then papal authority had effectively silenced debate on the issue by force after the Council of Constantinople in 381 but now Protestants were doing the same thing under the cover of "mystery." Bury offered a history in which all orthodoxy since Nicæa was attributed to the unlawful usurpation of ecclesiastical power by Catholics, the Athanasian doctrine being a "Roman" notion that was as unworthy of study as the Arian. Arius's doctrines had been supported by a number of subsequent councils while Athanasius had been condemned and banished by Constantine and by subsequent Emperors, on many occasions. In time, Athanasius made interest with the pope and used his wiles to help the pope and the ignorant Western Church gain ecclesiastical power. Finally, the "Consubstantialist" Theodosius put the matter beyond dispute. Unsurprisingly, Bury's text was ordered to be burnt by the University's Convocation in August, 1690, and the hapless Rector was forced out of office having become mired in accusations and counter-accusations of cavorting with female servants of the college.[16]

Apart from Bury's efforts to smooth the path to comprehension, the affair had become more complicated thanks to a further intervention by Nye and a response from William Sherlock that had occasioned yet another reply by Nye. As a minister in the Church of England, Nye's *Brief Notes* urged comprehension for antitrinitarians within the Church. Arguing for a credal minimalism and making a plea that Christians should be judged on whether they led an exemplary life, he reiterated the view that the Trinity expressed in the Athanasian Creed was an incomprehensible and unscriptural absurdity, imposed by devious and popish clerics for their own devices. In response William Sherlock, a non-juror, suggested that the author of *Brief Notes* was actually opposed *tout court* to the central doctrines of Christianity and that, in any case, the Trinity was not so difficult to grasp. Sherlock developed the idea that the three persons of the Trinity made up a union of people who were conscious of each others' thoughts. The mathematician John Wallis also joined in the debate and argued that one could conceive of the relationship between the three persons from a modalist point of view. There were many examples of something being triune from one perspective and a unity from another, for example, the three dimensions that made up a cube.[17]

[16] A true Son of the Church of England [Bury], *The Naked Gospel, etc*, (Oxford, 1690), pp. 29, 31, 37–8, 41–3 and 57–8; Trowell, "Unitarian and/or Anglican," pp. 83–4; J. Spurr, "The Church of England, Comprehension and the Toleration Act of 1689," *English Historical Review* 104 (1989), pp. 927–46; M. Goldie, "John Locke, Jonas Proast and Religious Toleration, 1688–92," in J. Walsh, C. Haydon, and S. Taylor, eds, *The Church of England, c.1689–1833* (Cambridge: Cambridge University Press, 1993)

[17] [S. Nye], *Brief Notes on the Creed of Athanasius* . . . . (London, 1690); W. Sherlock, *A Vindication of the Doctrine of of the Holy and ever Blessed Trinity, and the Incarnation of the Son of God. Occasioned by*

Replying to Sherlock's original *Vindication*, whose history of fourth century creeds and events was based substantially on the work of Charles II's chaplain William Cave, Nye greatly expanded the *Brief Notes* into a work entitled *The Acts of the Great Athanasius* and made stock anti-Trinitarian remarks about textual problems concerning the Trinity. Although brief, his demolition of the morals and actions of Athanasius constituted perhaps the most serious critique in English up to that point and turned conventional views such as those of Cave on their head, whose work is dealt with in the second part of this paper. That readers might be worried that this tale was completely inconsistent with that promoted by Sherlock in his *Vindication* concerned Nye but he argued that a "Judicious Person" could satisfy himself without a laborious search of the historical record. Although Sherlock defended Athanasius against Nye's criticisms of his conduct in his *Brief Notes*, Nye pointed out that Athanasius was frequently condemned in councils of the period and a contrary doctrine promoted. Sherlock might believe that his "for the most part good, honest, Catholic Bishops" had been pressured into acquiescence at these councils by Constantius but then he was caught on the horns of a dilemma: either Athanasius was really as bad as Nye had claimed and as vicious as the councils had said he was, or all Sherlock's "good, honest Catholick Bishops were a pack of the greatest Villains in nature, in condemning a Person whom they believed to be most innocent, and a Doctrine which they held to be fundamental and necessary to salvation." Nye finished by referring to the "fair Tale" Sherlock had woven from the work of "that *accurate and faithful* Historian Dr. *Cave*."[18]

Paradoxical Questions Concerning Athanasius

The debate over the Trinity gathered pace in the 1690s, fuelled by a continuous stream of antitrinitarian writings, by new arguments for toleration from writers such as John Locke, and by the deist threat posed by people like John Toland whose *Christianity not Mysterious* of 1696 seemed to the orthodox to owe a great deal to the tenets in Locke's *Essay Concerning Human Understanding* and his *Reasonableness of Christianity*. The High Church Anglican, Robert South, set his sights broadly, denouncing both Sherlock's mutual consciousness theory and the appeal to reason offered by the latitudinarian Archbishop of Canterbury, John Tillotson. Tillotson himself published some pro-Trinitarian sermons in 1693 although he was unhappy with the use of non-Scriptural

the Brief notes on the Creed of Athanasius, and the Brief History of the Unitarians, or Socinians (London, 1690; 2nd ed., London, 1691); J. Wallis, *Three Sermons concerning the blessed Trinity* . . . . (London, 1691); J. Wallis, *An Explication and Vindication of the Athanasian Creed, In a Third Letter, pursuant of Two former, concerning the Sacred Trinity* (London, 1691.) See Trowell, "Unitarian and/or Anglican," pp. 84–7, and M. Greig, "The Reasonableness of Christianity? Gilbert Burnet and the Trinitarian Controversy of the 1690s," *Journal of Ecclesiastical History* 44 (1993), 631–51.

[18] [S. Nye], *The Acts of the Great Athanasius, with notes, by way of Illustration, on his Creed; and Observations on the Learned Vindication of the Trinity and Incarnation, by Dr. William Sherlock* (London, 1690), pp. 4–5, 9–10.

terms and shortly before his death he announced that he wished Anglicans could be rid of the Athanasian Creed. The suspect epistemology underlying Locke's stream of publications came to the attention of divines such as Edward Stillingfleet, who pointed to the heretical implications of Locke's ideas of substance and identity and of his general approach to Scripture. As for Locke himself, he does not seem to have been overly concerned with the study of patristics but rather made detailed analyses of pertinent passages in Scripture. Having read most of the major anti-Trinitarian writers during his exile in the Netherlands between 1683 and 1689, it is entirely unsurprising that he and Newton should have quickly fallen into discussing antitrinitarian themes—albeit with great caution—when they met in late 1689.[19]

Whatever prompted Newton to reject orthodox Trinitarianism, he seems to have placed a premium on reading primary texts—whether patristic works or Scripture itself. The specifics of his anti-Trinitarian stance were derived as a result of immersing himself in these texts although he was aware of standard antrinitarian writings such as those of Sand, Johannes Crell, and Georg Enyedi. His theological notebook, containing notes from the 1680s and 90s, demonstrates that he was acquainted with many different sorts of doctrinal, controversial, and historical material. Newton's brand of antitrinitarianism, apparently developed early in his research, was radically subordinationist but with discernible Arian and Socinian strands. As to the former, he held that Christ was the pre-existent divine *logos*, an intelligent being who was made flesh and took on the form of a servant. It was this being and not a human soul that suffered on the Cross although, in a more Socinian vein Newton argued that it was for his obedience and sacrifice that Christ had been exalted by God to sit on His right hand. This action also made it right that Christ, previously merely the Son of God, could now be worshipped as the Lord or as the slain Lamb of God, without committing the sins of idolatry or polytheism. Whatever power was enjoyed by the Son was originally donated from the Father

[19] See [Nye], *Considerations on the Explications of the Doctrine of the Trinity, by Dr. Wallis, Dr. Sherlock, Dr. S—th, Dr. Cudworth, and Mr. Hooker; as also on the Account given by those that say, the Trinity is an unconceivable and inexplicable Mystery* (London, 1693); W. Sherlock, *An Apology for writing against Socinians* (London, 1693); J. Tillotson, *Sermons concerning the Divinity and Incarnation of our Saviour* (London, 1693); R. South, *Animadversions upon Dr. Sherlock's Book, entituled, A Vindication of the Doctrine of the Holy and ever Blessed Trinity* (London, 1693); and E. Stillingfleet, *A Discourse in Vindication of the Doctrine of the Trinity (with an Answer to late Socinian Objections against it from Scripture, Antiquity and Reason, and a Preface concerning the different Explications of the Trinity, and the Tendency of the present Controversie)* . . . . (London, 1696.) In general, see J. C. D. Clark, *English Society, 1688–1832: Ideology, Social Structure and Political Practice during the Ancien Regime* (Cambridge: Cambridge University Press, 1985), pp. 277–89. For a good account of the latitudinarian responses to Socinianism in the 1690s, see Reedy, *Bible and Reason*, pp. 125–35; for Locke, see D. D. Wallace, "Socinianism, Justification by Faith, and the Sources of John Locke's *Reasonableness of Christianity*," *Journal of the History of Ideas* 45 (1984), pp. 49–66; D. Wootton, "John Locke: Socinian or Natural Law Theorist?," in J. E. Crimmins, *Religion, Secularization and Political Thought: From Thomas Hobbes to John Stuart Mill* (London: Routledge, 1989), pp. 39–67; J. Marshall, *Locke: Resistance, Religion and Responsibility*, pp. 329–76 and, in particular, Marshall, "Locke, Socinianism and 'Socinianism'."

and indeed Newton at all times contrasted the absolute power and dominion of the true God with the derivative characteristics—which God willing, may include power and dominion—of the Son.[20]

Like many anti-Trinitarians, Newton argued in a number of places that ante-Nicene Fathers such as Justin Martyr and Tertullian had been subordinationists and had believed in Christ's pre-existence. However, he believed that pagan ideas were imported into Christianity and gave rise to heresies such as the view that the *Logos* was originally immanent in the Father and then later "generated" as a Son. Likewise, a physicalist interpretation of the relationship between Father and Son that stressed *identity of substance* instead of *similarity of power and dominion* was heathen and mistaken. As Newton put it in "Paradoxical Questions concerning Athanasius," the Nicene Council, "in decreing y^{e} Son homousios to y^{e} ffather understood that he & y^{e} father were two substances of one nature or essence as Curcellæus & Cudworth have proved beyond all cavils." When Hosius and others translated the Nicene term into Latin "to propagate a notion of a singular substance" it became *unius substantiae*, and in translating this language back again into Greek they "affirmed that there was but one hypostasis of y^{e} ffather son & Holy Ghost, as you may see in y^{e} letter of the Council of Sardica."[21]

The language of *hypostasis* was fatal to the unity of the church because it gave rise to "a difference between y^{e} Greeks & Latines, the Greeks suspecting the Latines of Sabellianism for holding one <singular> hypostasis or substance & y^{e} Latines suspecting the Greeks of Arianism for holding three hypostases." The physicalist interpretation became orthodoxy in the Latin West, giving rise to gnostic errors such as the view that the Son's substance was "entirely" the substance of the Father, that it had been a part of the Father's substance from eternity and, finally, that the Son's substance was generated by the unitary Deity being riven in two. The West was irrevocably Sabellian by the time of the Council of Sardica in 343, their opinion being that the Son was a λόγος ἐνδιάθετος or inward mind, that is the attribute of y^{e} hypostasis of y^{e} Deity."[22]

After Constantius's death in 361, in Newton's account, many "homoousians" (such as Athanasius) denounced others of their own kind as Sabellians for their adherence to the language of one *hypostasis* and instead they reintroduced the language of *homoousios*. Yet the original meaning of *homoousios* at Nicæa had not been "same substance;" according to Newton, at the time it

[20] See Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge: Cambridge University Press, 1984), pp. 313–7; Wiles, *Archetypal Heresy*, pp. 76–91, esp. 80–3.

[21] Wiles, *Archetypal Heresy*, pp. 85–93; William Andrews Clark Memorial Library, Los Angeles (hereafter WACL), "Paradoxical Questions concerning the morals and actions of Athanasius," fol. 79r. Struckthrough words indicate deletions; angled brackets represent additions. A later more polished version of the first half of this document is currently King's College Cambridge, Keynes MS 10.

[22] WACL MS, fols 39r–42r.

had denoted either "a substance arising from the substance of another thing by partition, eruption, efflux or emanation, or else it signifie[d] a substance like another substance." The first was the vulgar notion, the second the meaning agreed by the Council. However, afterwards it came to mean an "undivided substance <totally common to> the ffather & Son: & this indeed is y^{e} proper signification of *una substantia* but never was y^{e} signification of homousios till y^{e} Sabellians made it so." Further evidence from the pro-Arian historian Philostorgius, who related the "matter of fact" about the Nicene formulation, convinced Newton that some of the bishops had subscribed to *homoiousios* in writing, indicating that the general understanding at Nicæa had been that *homoousion* meant "like substance." Indeed, by the time of Milan (355) and Sirmium (357), the eastern bishops had convinced the western bishops that the "Greeks" in the East had subscribed to *homoiousios* and that the Latins had misinterpreted the Nicene Creed. According to Newton, the western bishops examined the Nicene subscriptions and found them to be as the Greeks had claimed, but later Athanasius and his allies rewrote history, reintroduced *homoousios* instead of *hypostasis*, and made out that those who had subscribed to *homoiousios* at Nicæa had done it fraudulently. This was to make Constantine and other onlookers fools for letting them get away with it but Newton concluded that "it has been y^{e} constant practise of y^{e} Catholicks to cry out fraud at every thing w^{ch} makes against 'em before they know whether it be so or not & thereby they have corrupted all history."[23]

The Council of Nicæa

The radical nature of Newton's history of fourth century Christianity and its doctrines is best understood by setting it beside orthodox accounts. Two texts from the Restoration period exemplify Anglican approaches to the complex amalgam of lives, doctrines, and events of the fourth century. The first, composed in 1664 by Nathaniel Bacon was a document that blamed the Catholic Church for hijacking trinitarian Christianity but that nevertheless concentrated its fire on the Arian heresy. The second, by William Cave, and published in 1683, was less critical of Catholicism and became the most influential general account of the topic in the following decades. In Bacon's *History of the Life and Actions of St. Athanasius*, he noted that God had made Constantine a Christian at the same time as the heresies of Arianism and popery had made their appearance upon the stage. Bacon defined "moderate" Arians as believers in *homoiousios* (that the Son was 'like' the Father in essence and substance) and, with many of his contemporaries, described followers of Arius as "Eusebians" after the Arian sympathizer Eusebius of Nicomedia.

[23] Ibid., fols 42r–44r; see also Wiles, *Archetypal Heresy*, p. 89.

He briefly discussed the important Meletian schism, caused by the refusal of Peter, bishop of Alexandria, to admit Meletius to communion on the grounds that Meletius had allegedly offered incense to heathen gods during the persecutions of Christians. Meletius created a separate church, the self-styled Church of the Martyrs, which constituted the "first example of a separation or schisme meerly upon that point of Church government, without any difference at all in point of Doctrine." Later the Meletians would become Arian.[24]

According to Bacon, Arius himself began to dispute about the Trinity with Alexander, Peter's successor in the Alexandrian see, but the priest had "not onely the ignorance of the times to favour him, but the corruption of nature, and the Devil and all to help against the true understanding" of basic Christian principles. The bishop condemned Arius's apparent denigration of Christ, while Arius accused Alexander of Sabellianism, and the bishop was forced to call a synod at Alexandria to decide the issue. It found against Arius whereupon he and some other "unstable" characters refused to subscribe to the council's decision. Fleeing to Palestine and then to Nicomedia, Arius met up with his friend Eusebius (of Cæsarea, the historian of Constantine's life and deeds) who influenced Constantine to call another council at Alexandria. This council failed to achieve unity in the Church and, in 325, an exasperated Emperor called the famous Council at Nicæa where the youthful Athanasius supported Alexander against Arius and disputed with him about the Trinity. This Council devised the eponymous creed asserting that the Son and Father were *homoousios* (later translated by Western theologians as "consubstantial") and, despite the recalcitrant bishops Eusebius of Nicomedia and Theognis of Nicæa refusing to subscribe ("being insnared in the Arian Principles"), this Council excommunicated and banished Arius along with some of his followers.[25]

For Cave, Arius was a key element in the devil's strategy to exterminate traces of authentic apostolic Christianity. He went along with the schism

[24] "N.B.P.C. Catholick," [i.e. Nathaniel Bacon] *The History of the Life & Actions of St. Athanasius, together with the Rise, Growth and Down-fall of the Arian Heresie. Collected from Primitive Writers* (London, 1664), pp. 5–6, 10–11; W. Cave, *Ecclesiastici: or, the History of the Lives, Acts, Death & Writings of the most Eminent Fathers of the Church that Flourisht in the Fourth Century. Wherein Amongst other things an Account is given of the Rise, Growth, and Progress of Arianism, and all other Sects of that Age descending from it etc*. (London, 1683.) There are two alternative title pages to the work ascribed on one version to Nathaniel Bacon; both were printed by D. Maxwell although the version with Bacon's name is simply titled "The History of Athanasius . . . " The author is probably the parliamentarian Nathaniel Bacon (1593–1660), who became "Master of Requests" to Cromwell in 1657. He was also the author of *A Relation of the Fearfull Estate of Francis Spira* . . . , which first appeared in 1638 and which was often reprinted in the seventeenth-century, and of *An Historicall Discovery of the Uniformity of the Government of England . . . till the reigne of Edward the thirde* (1649), a tome that assailed the royal prerogative (and which was followed by a "Continuation" of the topic in 1651).

[25] Bacon, *Life and Actions*, pp. 12–15, 23, 26–9. For recent accounts of the following episodes, see R. Williams, *Arius: Heresy and Tradition* (London: Darton, Longman, and Todd, 1987); R. P. C. Hanson, *The Search for the Christian Doctrine of God* (Edinburgh: Edinburgh University Press, 1988); D. W-H. Arnold, *The Early Episcopal Career of Athanasius of Alexandria* (Notre Dame, IN: University of Notre Dame Press, 1991); T. D. Barnes, *Athanasius and Constantius. Theology and Politics in the Constantinian Empire* (Cambridge, MASS: Harvard University Press, 1993), esp. pp. 10–55.

set about by Meletius, who from the beginning "vomit[ed] up nothing but railings against Peter and his successors." A Libyan by birth—a country Cave denounced as "fruitful in monstrous and unnatural Productions"—Arius was a man "of a subtle and Versatil Wit, of a turbulent and unquiet Head, but which he vail'd with a specious Mask of Sanctity." Having criticized Sand's *Ecclesiastical History* for painting an overly rosy picture of contemporary sympathy for the Arian cause, Cave then described how Alexander had won election to the see of Alexandria. The 'Arian' historian Philostorgius reported that Arius had received more votes but had stepped aside for Alexander, but Cave dismissed as highly unlikely. As for Arianism itself, Cave believed that Arius had got this from the Alexandrian Platonists. He cited Cudworth to the effect that the authentic Trinity had originally asserted three divine hypostases but that the "Junior Platonists" had "stretched" the differences between them in order to make the third hypostasis the "immediate soul of the world" and to distinguish this view from that of Christianity. This doctrinal variation between hypostases was imbibed by Arius's tutor, Lucian, and passed on to the pupil.[26]

Cave related how Arius's "impious and pernicious Principles . . . were speedily entertain'd by Persons of loose and instable Minds" and he noted that Arius "diffus'd the Venom" at every gathering where he was allowed to preach. Alexander's gentleness was no match for the crafty priest and "the stubborn Heretick was not to be wrought upon by Arts of Kindness." Cave cited Athanasius's *De Synodis Armini et Seleuciae* noting that just before Nicæa, Arius wrote a letter to Alexander "seem[ing] to smooth over things with a plausible Gloss . . . yet in fine, [it] plainly declar'd that the Son is neither Eternal nor Co-eternal, nor Co-essential with the Father." At Nicæa, Constantine brought in the help of the entire Church, men "venerable for their Age, and their Confessions, and constancy in the Faith; for the gravity of their Manners; the Wisdom, Learning, and Reason of their Arguments and Discourses." Arius, on the other hand, dragged in with him a retinue of insolent disputants "to retard and intangle the Proceedings of the Synod." Of the orthodox, "none behav'd himself with more smartness and accuracy than *Athanasius*."[27]

When the Arian case was heard before the judicious Emperor, they "represented their Propositions in such general Terms, and were so subtle and deceitful in their Explications, that the Fathers thought they could never particularly enough provide against them." Indeed, Arius seemed to grant whatever was put forward by the orthodox, agreeing in deliberately vague terms that Christ was God, was naturally of God, and was the power, image and wisdom of the Father. It was against this "Crafty and Fraudulent shifting" that the Fathers devised the *homoousios* compromise. According to Sozomen, this compromise was almost universally accepted but, according to Philostorgius,

[26] Cave, *Ecclesiastici*, pp. 40, 41–2, 44–5,

[27] Ibid., pp. 45, 53, 58, 59, 60–1. See also Barnes, *Athanasius and Constantius*, pp. 17–8.

the Arian party only agreed at the behest of Constantia, Constantine's sister and an Arian sympathiser. They did not, however, consent to the deposition of Arius. Even in subscribing to the confession, as Cave had it from "their own historian" Philostorgius, they did it by "Arts of Treachery and Deceit, reserving to themselves their own Sence, and subscribing not ομοούσιος but ὁμοιούσιος, not that the Son is of the *Same* but only of a *like Essence* with the Father." The council banished Arius, along with the deacon Euzoius and two others, but treated Meletius more gently, "his fault being not Heresie but Schisme only." He was allowed to keep the title of bishop, and those Meletians already ordained were admitted to communion, but henceforth the succession of Meletian bishops was to be chosen by the people and ratified by the Bishop of Alexandria. Eusebius of Nicomedia did not fare so well and—having been charged by Constantine with communicating with his rival Licinius, plotting against him, and engaging in persecution—was exiled to France.[28]

Relying on a report in Sozomen, Cave next told how the public "became passionately clamorous" for the election of Athanasius to replace Alexander, when the latter died soon after Nicæa, "publickly putting up their Petitions to God in that behalf, continuing in those Devotions day and night." However, Philostorgius reported that Athanasian supporters coerced Egyptian bishops into voting for him and that Athanasius then forged letters to Constantine on behalf of the people of Alexandria. According to Sozomen, the Arians, in a "spiteful and groundless" calumny, claimed that Athanasius had been chosen in secret and against custom by only six or seven bishops. For Cave, this was all libel: "There needs no dispute, who are to be trusted in this Matter, whether profess'd and sworn Enemies, whose Custom was, to support their Cause by Arts of craft and falshood, or those who were themselves present at the Action, and made their publick Protestation, while the thing was but lately done." In fact, as Gregory of Nazianzen proved, Athanasius's elevation to the bishopric was "not as his intruding Successor, by Force and Slaughter . . . but after a Divine and Apostolick manner." Athanasius was also technically too young to hold such an exalted office but "it was thought fit it seems for once, to dispence with the rules of Ecclesiastick Discipline." The Arians now decided to unite against him and brought in the Meletians to their side.[29]

Soon after Athanasius's appointment, Arius and Euzoius found some expedient to return from banishment as (slightly later) did Eusebius of Nicomedia and Theognis, who had allegedly pretended to retract their opposition to the Nicene Creed. According to Bacon, these men "proved ever after persecutors, not only of *Athanasius*, but all others that held the Nicene faith." Athanasius was now forced to deal with some business at Mareotis concerning one Ischyras, who was acting as a priest without authority, and he sent his presbyter Macarius to sort it out. At the same time, Eusebius of Nicomedia asked

[28] Cave, *Ecclesiastici*, pp. 62–4, 66–7, 68–9; see Williams, *Arius*, pp. 70–2.
[29] Cave, *Ecclesiastici*, pp. 71–2. See Barnes, *Athanasius and Constantius*, pp. 18–21.

Athanasius to accept Arius for communion but was rebuffed. Having wormed his way back into the Emperor's affections, Eusebius began to agitate Constantine against Athanasius and, (according to Cave) "by crafty Insinuations," succeeded in persuading him to write to Athanasius, requesting him "in a positive and peremptory manner" to readmit Arius. Athanasius refused, saying that the Catholic Church could not hold communion with a heretic, whereupon Eusebius began, as Bacon put it, to insinuate that Athanasius "was a pragmatical fomenter of strifes and dissention amongst the Churches." According to Cave, Eusebius resorted to "downright Methods of Fraud and Falshood" in convincing the Meletians to send their own bishops to Constantine's court, armed with grave accusations against Athanasius. In turn, Athanasius sent two of his own men to the Emperor in order to win back his affections; this action succeeded in turning Constantine against the Meletian accusers but Athanasius was requested to answer the charges in person.[30]

At court, Eusebius of Nicomedia and Theognis continued to attract nefarious people to their cause, such as those Bacon denounced as the "court-loving" Arian bishops, Valens of Mursa (Esseg) and Ursacius of Singidunum (Belgrade.) Cave remarked that Eusebius "set his Engines on work for promoting the *Arian* Cause" and put up some Meletian bishops to spreading false rumours about Athanasius; accordingly, they used the case of Ischyras to weave their sordid tale. According to Athanasius, he had sent Macarius to Mareotis to find out what was going on and to summon Ischyras to answer various allegations but Ischyras was too sick to comply and, in any case, denied the things he was alleged to have done. Somewhat nebulously in Cave's account, Ischyras's father told his son to "shift for himself" whereupon he sought help from the Meletians and fled to Nicomedia, "the usual Refuge of discontented Persons." Here, having allegedly been promised a bishopric of his own by Eusebius, he and the Meletians devised a plan against Athanasius. In addition to charges of treason and illegality regarding Athanasius's appointment to the bishopric, they accused Athanasius of ordering Macarius to break the communion chalice, of overturning the altar, of burning the Bible, and, finally, of burning down Ischyras's house. Constantine heard these accusations in person in early 332 and exonerated Athanasius, condemning his enemies as "wicked Wretches."[31]

Soon afterwards the Meletians wrote to Constantine repeating the charges against Athanasius and adding that he had also organised the murder of the Bishop of Hypsele, Arsenius. For good measure, the Meletians produced evidence in the form of a dead man's hand, ostensibly that of the alleged victim. Constantine found this charge impossible to ignore and arranged for

[30] Bacon, *Life and Actions*, pp. 32, 35, 37 and 41–3; Cave, *Ecclesiastici*, pp. 73–5; Williams, *Arius*, pp. 74–7.

[31] Cave, *Ecclesiastici*, pp. 74–7, esp. 74, 76, 77; Bacon, *Life and Actions*, pp. 37–46, esp. 39; Barnes, *Athanasius and Constantius*, pp. 20–1.

his half-brother, Dalmatius, to investigate. Athanasius sent a deacon to inquire into the whereabouts of Arsenius, "whom with much ado he found to be alive and well", dispatching Macarius to inform the Emperor of what he had found. The Emperor, according to Cave, "wondring at mens immoderate boldness and confidence," told Dalmatius to stop the proceedings and to banish Athanasius's accusers. Constantine told Athanasius that the Meletians were merciless, "wicked and execrable Persons . . . men hardned in Impiety, and who attempted the greatest Absurdities meerly to gratifie Envy, Emulation, and a seditious Mind." Eusebius nevertheless prevailed upon the Emperor to call a council at Cæsarea, a place and people Bacon claimed were "over-run with Arianisme," to be presided over by Dalmatius. However, Athanasius did not appear, suspecting that it was biased in favour of the Arians and his enemies had no trouble in convincing Constantine that this was due to rank disloyalty.[32]

Tyrian Convictions

Athanasius's non-appearance at Cæsarea irked Constantine who, armed with yet more Meletian charges of sedition and persecution, decided to hold a new set of proceedings at Tyre in 335. While Macarius was forcibly brought to the synod by soldiers, Athanasius declined to appear at first, fearing that the gathering was irrevocably prejudiced against him. In the end, he turned up with an entourage of forty-seven Egyptian bishops "as Witnesses of his Integrity, and Advocates of his Cause." To Cave, the proceedings merely treated Athanasius as a criminal on trial and he was charged with vice, immorality, impiety, and profanation. Accusations of disobedience and threatening behaviour (due to the size of his retinue) were thrown in for good measure. His plucky defenders managed to score some points of their own, such as accusing Eusebius of Cæsarea of idolatrous behaviour under the Diocletian persecutions, but the court went ahead and heard all the charges except those of treason and sedition. Along with Callinicus, the Meletian bishop of Pelusium, Ischyras testified against Athanasius. Ischyras asserted that he had been chained and thrown into prison while Callinicus claimed that he had been deposed by Athanasius for failing to communicate with him. Cave related that these and other things reported by Philostorgius must have been dismissed for lack of proof because they were barely mentioned in any of the records.[33]

The next charge was that Athanasius had "offered violence" to a woman, "a common strumpet" according to Bacon, and had assaulted her despite her

[32] Cave, *Ecclesiastici*, pp. 77–8; Bacon, *Life and Actions*, p. 44; Barnes, *Athanasius and Constantius*, pp. 21–2

[33] Cave, *Ecclesiastici*, pp. 79–81; Bacon, *Life and Actions*, pp. 45–6; Barnes, *Athanasius and Constantius*, p. 22.

vows of chastity. Having "entertain'd *Athanasius* into her house," as Cave put it, he had allegedly "violently forc'd her into lewd Embraces." Before this charge was laid on him, however, Athanasius had "smelt something of the Design" and brought one of his presbyters, Timotheus, to take his place during the questioning of the woman. When Timotheus, interrogating the woman as if he were Athanasius, asked her whether he had ever been at her abode and had tried to attack her, she replied, "stretching out her hand, and pointing to him with her finger, yes, yes, you are the man, who forcibly press'd upon me, and stain'd my Chastity and my Honour, adding, as in such cases is usual, both the time and the place." Cave reported that Athanasius himself then came forward and asked her who was behind this slanderous plot but was overruled by a "clamorous Answer, that they had greater Matters against him to be examin'd, and for which they had Evidence beyond all Exception." According to Sozomen, this passage was too "light and immodest" to be included in the records of the Council though the "Arian historian" Philostorgius turned the story the other way round and made Athanasius complicit in a plot along with the woman. In this version, under Athanasius's "direction," the woman "charg'd her great Belly upon Eusebius of Nicomedia . . . who by a much like strategy, brought it to light." With regard to Philostorgius's credibility, Cave warned: "how much stress is to be laid upon his Relations, especially when levell'd against the Catholick Party, the judicious Reader needs not be told."[34]

The following accusation was potentially the most serious. Cave termed it the "Tragy-Comick Scene of *Arsenius* the *Melitian* Bishop" although the proceedings relating to it Bacon called it "an uncouth charge of a stranger nature." As we have seen, Athanasius's enemies had charged him with the murder of Arsenius, and with cutting off his right arm, claiming that this had been done for magical purposes "to make use of it in Arts of diabolick Conjurations." Cave drew from Sozomen's account to suggest that the reason behind the affair was that Arsenius had "fallen under some great Irregularity," had been asked to appear before a court to answer these charges, and had then disappeared. John, the leader of the Meletians, had used this opportunity to hide Arsenius with a presbyter of a monastery in Thebais called Pinnes. At this point, the Meletians had shown off the amputated hand and the news had quickly come to the ear of Constantine who put Dalmatius on the case. From Athanasius's own account in his *Apology against the Arians*, a text that provided the vast majority of information concerning this and other episodes relating to Athanasius's career after Nicæa, Cave narrated how Athanasius had sent one of his deacons to find Arsenius who had been missing for some years. The deacon found the location of the monastery where Arsenius had been hiding but "the Bird was flown," Pinnes having conveyed Arsenius by raft down to lower Egypt. However, Athanasius's supporters brought Pinnes and another

[34] Bacon, *Life and Actions*, p. 47; Cave, *Ecclesiastici*, p. 81; Barnes, *Athanasius and Constantius*, p. 22.

accomplice before the Governor of Alexandria and there the miscreants confessed their their kidnapping Pinnes, as Pinnes himself admitted in a letter to John.[35]

At the Tyrian trial itself, Athanasius's accusers duly brought out the hand "at which," Cave related, "a great shout was made in the Synod, many believing it to be true, and others, that nothing could appear to the contrary." Athanasius then asked the judges whether any of them knew Arsenius by sight. Whether he had "persuaded" Arsenius to turn up at Tyre, having discovered him hiding in the town, or—having previously been warned to keep out of sight by the Meletians—Arsenius had appeared out of curiosity to see how the case would go, Athanasius then produced a man that was confirmed as Arsenius by those competent to decide. In a phenomenal *tour de force*, Athanasius theatrically "turn[ed] back the man's Cloak, and shew[ed] them one of his Hands; and after a little pause, to give them time to suspect it might be the other hand, he put back the other side of the Cloak, and shew[ed] the other." Cave continued: "Thus ended the Plot, not more to the Pleasure and Satisfaction of the Innocent, than to the shame and Confusion of the Guilty, amongst which *John* the *Meletian* Bishop, the main Contriver of the whole Scheme, is said to have slunk away in the Crowd." Others continued to lambast Athanasius for being a conjuror, arguing that he had used his magic to cast a mist over the eyes of the council and they incited members of the assembly to tear him to shreds although he was saved by the civil power. Once the affair had settled down, some of the Meletians defended their conduct by saying that one of Athanasius's bishops had caused Arsenius's house to be burned down and had forced Arsenius to be whipped and imprisoned. When Arsenius escaped from his incarceration, and had not been seen again, murder at the hands of his persecutor had been a reasonable inference. Cave concluded his account of this episode by pointing out that Arsenius had subsequently written to Athanasius affirming his own orthodoxy and John himself, "repenting of what he had done, confess'd the injuries that had been done to *Athanasius*, and reconcil'd himself to him, as himself witnessed in his Letter to the Emperor."[36]

Two other indictments were outstanding against Athanasius. Concerning his supposedly illegal elevation to the bishopric of Alexandria, and the perjury of those who elected him, the charge was made that he had failed to convince local bishops that he had cleared himself of accusations against him and had then put them in prison. Yet for Cave, evidence recorded in Athansius's works made it clear that he had been elected by the popular consent of the Alexandrian people and that "his entrance upon it was so far from being entertained with Tumults and Murmuring, that it was celebrated with popular Triumphs and Thanks to God." The other charge concerned his treatment of Ischyras and

[35] Bacon, *Life and Actions*, pp. 47–9, esp. 47, 48; Cave, *Ecclesiastici*, pp. 81–2; cf. also Barnes, *Athanasius and Constantius*, p. 22.

[36] Cave, *Ecclesiastici*, pp. 82–3; Bacon, *Life and Actions*, pp. 48–9.

the accusations against Athanasius and Macarius were all dismissed. Ischyras could not have been ministering at the altar when Macarius arrived since he was ill in bed, the place was not a church but a farm-house, and catechumens were then in the place so the Eucharist could not have been administered. Witnesses confirmed that Macarius had not broken the communion cup, overturned an altar, or burnt a Bible, and they testified that Ischyras's entire story was "forged and fabulous." In fact, Cave continued, Ischyras had then gone on to confess the entire plot in front of six presbyters and eight deacons who put their names to the deposition. He claimed that he had been forced to do it by some Meletians and knew nothing of any wrongdoing by Athanasius, wishing only to be admitted into orthodox communion.[37]

Newton as Litigator

These were complex matters and Newton needed great skill and not a little courage to overturn the orthodox account. As usual, his most powerful argument was that Athanasius acting in monumental self-interest, had only propounded his version of events much later in his career. The standard story, as we have seen, was that Athanasius refuted the accusations of his enemies at Tyre by producing Arsenius alive and by pulling out Arsenius's hands for all to see. However, Newton "suspected" this story because no one mentioned it in the periods that followed. When Athanasius called a council at Alexandria some years later, he wrote a "large and elaborate" letter to the world defending himself against the proceedings there. Yet there was nothing of the dead man's hand nor of Arsenius's appearance at Tyre in this letter, nor in a letter that pope Julius wrote to the Eastern bishops defending Athanasius, nor even in the two lengthy letters that he and over two hundred and fifty bishops wrote from Sardica in 343. They mentioned that Arsenius was then alive but

> they do not say that he <appeared alive at Tyre> tho that one thing had it been true would have been more to y^{e} purpose than all the rest which they say. They do not so much as say that they or any of them had seen him alive, or that they had any witnesses of his being alive as they might <(and surely would)> have done had he been seen alive before all y^{e} world at Tyre.

The key point for Newton was that, in these same letters appearing in Athanasius's own second *Apology* and in other writings by his friends, they told the tale differently "as if the accusers produced before y^{e} Council not a dead man's hand but a dead body & Athanasius produced against them not Arsenius alive but his letter only." The accusers "were so far from being shamed that the Council notwithstanding the Letters proceeded to condemn Athanasius for the murder."[38]

[37] Cave, *Ecclesiastici*, pp. 83–4

[38] WACL MS, fols 15r–16r; Keynes MS 10 fols 9–10r.

The Council of Sardica, of 343, in a letter to the Church of Alexandria, related how the Council of Tyre had commanded the dead body of Arsenius to be laid before it and from this evidence it had clearly been this object and not a "magical salted" hand that had been inspected. For the forensic specialist this was crucial: "In cases of murder tis usual to have dead bodies viewed for passing judgment upon them; & this was done in y^{e} Council, that by y^{e} features & other marks & wounds & testimony of those who knew Arsenius or had seen his body at y^{e} time of y^{e} murder & buried it & dug it up again the Council might be satisfied whether he was murdered & how." Newton concluded that "to sham y^{e} proceedings of the Council some Jugler (for I will not say sorcerer) has transformed y^{e} whole body into a magical hand." Similarly, and "by the same Art," the letter of Arsenius had been transformed into the man himself. Even in the letter Athanasius and his bishops wrote from Alexandria, the only evidence insisted upon was Arsenius's epistolary testimony to the Council of Alexandria: "This they wrote five years after y^{e} Council of Tyre when things were fresh in their memory & contrary stories were not yet invented."[39]

All parties agreed that Athanasius was forced to leave Tyre, although the reasons given for his flight differed markedly from one onother. Newton could not conceive why Athenesius would have been banished at all if Arsenius had appeared at Tyre. His punishment was comprehensible only if there had been a dead body rather than a letter. Yet that the Council did condemn Athanasius as a murderer was agreed by the testimony of Athanasius and his friends, not merely at the councils of Alexandria and Sardica, but also both in the letter from the Eastern bishops to Pope Julius and the Council of Antioch and in the letter the same bishops wrote "to the world" after returning from Sardica. What was one to make of this? The letter was the only grounds Athanasius and his friends had for their story that Arsenius was alive but according to Newton:

> had they known where he was or where any witnesses were w^{ch} had seen him as they would have known of multitudes had he been seen by all the world at Tyre they would have sent for him or the witnesses & had them in readiness at their Councils to satisfy all their party & made a greater noise about such evidence than about a Letter w^{ch} no upright Court of Judicature would allow for any evidence at all. And yet I cannot find that in all their endeavours to overthrow y^{e} Council of Tyre they ever pretended to have so much as one living witnesse who had seen Arsenius alive.[40]

There was more evidence, if one looked closely enough, for Athanasius's friends complained that the Council of Tyre proceeded against him *despite* the evidence of the letter and had exiled him as a murderer. But in that case, *both* sides agreed that Arsenius had not been seen alive at the council; the one

[39] Keynes MS, 10 fols 10r–11r; WACL MS fols 16r–7r.
[40] Keynes MS, 10 fol. 11r; WACL MS fols 7r–8r.

arguing that the council was rotten and had banished Athanasius despite the evidence of the letter; and the other that he had actually committed the crime. The Eastern bishops constantly, Newton pointed out, kept up their view that the evil deed had in fact taken place; "for my part," Newton wrote, "I can more easily believe what both parties affirmed in that age before newer stories were invented: then that y^{e} Bishops of all y^{e}east should condemn Athanasius for merdering a man who appeared alive before them in y^{e} midst of y^{e} Council <& owned himself to be Arsenius> & was known by many there; and be able to satisfy y^{e} Emperor Constantine & the eastern nations of the justness of <such a> sentence." For when Athanasius appealed against the decision, "the Emperor heard the cause over again between Athanasius & y^{e} Legates of y^{e} Council & he & the east were satisfied in their proceedings." In that case, the entire story about the proceedings at Tyre that had been handed down to posterity was a fable "unknown in those times and therefore invented afterwards. And I suspect Athanasius to be y^{e} inventor of it because he tells it first of any man in his second Apology written in the Wildernesse at the same time that he broached y^{e} story of y^{e} death." If Athanasius "knew it to be fals (as he did if it were so) then he was not imposed upon by others, but told it upon others & so is y^{e} Author."[41]

Three more key pieces of evidence now demanded Newton's attention: the first was the letter written by the priest, Pinnes, to John, the Meletian bishop, confessing his sheltering of Arsenius in the monastery; the second, the notorious letter, allegedly composed by Arsenius himself, written to Athanasius before the Council of Tyre; and the third, the confession of Ischyras witnessed by a number of presbyters and deacons. As for the last, Newton carefully dismantled the authority of Ischyras's letter absolving Athanasius of the crimes alleged against him. Again Newton "suspected" the text, this time because "it looks as if contrived rather for the interest of Athanasius then that of Ischyras, & seems more like a formal recantation or certificate then a free Letter, & also conteins a ridiculous story." No one in their right mind would try to secure false accusers or witnesses by forcing and beating them and "were a false accuser or witness so procured tis not likely that after his discovering the knavery he would go on in accusing or witnessing as Ischyras did to y^{e} end. Could a beating bout make Ischyras so hearty in the cause?" Why too, had Athanasius not secured Ischyras's confession before witnesses? "Would Athanasius send up & down y^{e} world to seek Arsenius & not accept of Ischyras when he offered to come in, but content himself wth a bare letter? These things," Newton pontificated, "don't consist." Nor was it above suspicion that the letter contained witnesses for "witnesses are never set to Letters. They are set to no sort of writings but such as are designed for evidence in legal proceedings & therefore shew that the author of this letter designed it for evidence." So

[41] Keynes MS, 10 fol. 11v; WACL MS fol. 9v.

Athanasius "designed by those witnesses to make it evidence for Athanasius against Ischyras. For there was no need of such evidence against any body else."[42]

To Newton the letter, unsigned by any of the witnesses alleged to be present, was bizarre: would anyone, he asked, "call his friends together to be witnesses to a writing & not make them set their hands to it? If Ischyras wrote this Letter he either designed it for evidence or he did not. If he did not he would have made no mention of witnesses. If he did he would certainly have caused them to set their hands to it." Newton surmised that it appeared to have been written by somebody else "who had a mind to give credit to it by witnesses, but knew not how either to procure or counterfeit their hands." Nor were any witnesses ever called to prove the truth of the letter at the following councils of Alexandria, Rome, and Sardica. If no effort had been made to get the letter authenticated at Tyre then this betrayed a guilty conscience and, if such an attempt had been made and witnesses unsuccessfully sought to vouch for its contents, then this proved the letter false. To Newton the whole thing was a farrago and "So impudent a case as this was scarce ever brought before a civil Magistrate." Nor had anything like this ever been allowed in ecclesiastical courts, except at the Council of Alexandria where Athanasius personally presided over the synod.[43]

Athanasius's escape from the charge of adultery was dismissed by Newton as the result of his 'friends' rewriting history. The case of Ischyras also demanded his attention. From a brief report in Hilary, Newton found that Athanasius had been accused at Sardica of tyrannical behaviour towards the Meletians and of personally mistreating Ischyras and his religious accoutrements. The Athanasian party, as Newton saw it, denied the whole thing and claimed that Athanasius had sent his priest Macarius to interview Ischyras and that Ischyras had run to the Meletians and Eusebians to start his plotting. Yet on this account there was no plausible reason for accusing Athanasius; "cunning men", Newton opined, "never venture to frame false accusations wthout some considerable colour of circumstances handsomly laid together."[44]

In fact, Newton found evidence from a number of sources that Athanasius and Macarius had both been accused of the offences. What had really happened was that Macarius had been sent first to warn Ischyras about his conduct and that when the latter continued his activities, Athanasius had arrived and smashed the place up. Athanasius had slyly conflated these two occasions and, according to Newton, had undertaken "to prove (not before y^{e} Council of Tyre where y^{e} accusation was understood but afterwards amongst y^{e}<credulous> western Bishops & others of his own party) that Macarius went alone wthout Athanasius & found Ischyras sick in bed in a place w^{ch} was not a Church, on

[42] Keynes MS, 10 fols 14v–15r; WACL MS fols 21r–22r.
[43] Keynes MS, 10 fol. 16r–v; WACL MS fol. 22r–v.
[44] Keynes MS, 10 fol. 18v; WACL MS fol. 26r.

a day w^{ch} was not y^{e} Lords day, & only reproved him." From records of the Council of Tyre left at Rome, Newton found that the witnesses interviewed by the six representatives sent from Tyre to Mareotis to uncover the truth had told different stories. Some had mentioned that Macarius had found Ischyras sick in bed, as Athanasius had said, but others had mentioned that Athanasius had discovered him administering the Eucharist. In his deposition to the pope over a decade later, it was an easy matter for Athanasius to suppress the second piece of evidence (since it was written in Greek), and to persuade the pope that, because Ischyras was ill, he could not have been celebrating the Eucharist. End of story: "Now if <Athanasius shuffled in making> this Defense then its plain that he was gravelled[45] & wanted a just defense. Which is enough to decide the Question."[46]

The Status of the Council

Athanasius had rebutted the charges to the satisfaction of the two orthodox seventeenth-century authors, and by rights the tawdry case should have been dismissed but, thirteen hundred years earlier, his arguments were to no avail. At one point in the trial, it was decided to send another official delegation to Egypt in order to determine the truth of the issue but, since it contained Theognis, Valens, Ursacius and others, Cave thought that Athanasius "perceiv'd which way things were like to go." Indeed, the forty-seven Egyptian bishops presented a petition to the synod complaining of the Eusebians' "fraudulent and mischievous Designs." As the commissioners went about their business in Alexandria and elsewhere, Athanasius thought it prudent to leave Tyre. In the Egyptian capital, the commissioners "carried themselves like men resolved to go through with their Work, endeavouring to exert Confessions by drawn Swords, Whips, Clubs, and all methods of Cruelty and Severity, not sparing even the devoted Virgins, whom they suffered the very *Gentiles* to strip naked." Jews and gentiles alike were called to give evidence against Athanasius at Mareotis and the delegates, "having patch'd up what evidence they could any wayes rake together, returned to Tyre, where Athanasius being fled, it was no hard matter to procure his Condemnation." Although Athanasius would later write a book defending his flight, and would be acquitted of any malefaction by supporters such as the monk Anthony, his escape was taken as tantamount to an admission of guilt and he was condemned by the synod. For Bacon, it demonstrated "to all the World that the opinion that a Council cannot erre, is but a notion."[47]

[45] To "lay or strew with gravel; perplex, puzzle, nonplus," see *Concise Oxford Dictionary*, s.v. "gravel."
[46] Keynes MS, 10 fol. 19r; WACL MS fols 26r–27r.
[47] Cave, *Ecclesiastici*, pp. 84–7, esp. 85, 86, and 87; Bacon, *Life and Actions*, pp. 50–3, esp. 50; Barnes, *Athanasius and Constantius*, pp. 22–3. See also R. Peeters, "Comment Saint Athanase s'enfuit de Tyr en 335," *Bulletin de l'Acad. Royale de Belgique, Classe de Lettres* 30 (1944), pp. 131–77.

With Athanasius out of the way, the Arians now attempted to get their man appointed Bishop of Alexandria. For some time Constantine had planned another council at Jersualem to coincide with the dedication of his great Church of the Holy Sepulchre and the members of the Council of Tyre prepared to move to the holy city. Apparently owing to the fact that his sister was a sympathiser of an Arian presbyter at court, Constantine asked the council to consider Arius's case. For Bacon, this was what happened when people in authority trusted private matters "to a woman whose affections many times are strong and predominate; and [who] in the general, are more skilfull at making of fires than men are." Constantive also asked Arius and Eusebius of Nicomedia to show their orthodoxy by subscribing to the Nicene Creed which they did to his satisfaction, although he warned them that God would punish them for perjury if they were lying. At the Jerusalem synod, neither "Theologically nor Politically innocent" according to Bacon, their orthodoxy was again accepted and Arius's punishment at Nicæa was rescinded. In the meantime Athanasius, who had refused to accept Eusebius into communion at Alexandria, persuaded Constantine to hear an appeal in person. Constantine called Athanasius's accusers at Tyre and, seeing that the Emperor was tending towards supporting Athanasius, they "wisely wav'd the insisting upon the old Calumnies of the Cup, and the Table, and the death of *Arsenius*, which they knew were not defendable at a fair and impartial Audit." Instead, they invented a new charge, viz. of treason, accusing Athanasius of preventing corn from reaching Constantinople from Alexandria. Whether to secure peace or save the life of Athanasius, "whose life [Constantine] knew to be perpetually in danger by the restless Attempts and Machinations of his Enemies," the Emperor (now a "heathenish Christian Arian" according to Bacon) did not depose the bishop but banished him to Trier.[48]

Newton could hardly let this slur on the deliberations at Tyre and Jerusalem (which he treated as one council) pass unremarked. Athanasius's 'friends' and apologists—that is, all the ecclesiastical historians except Philostorgius—had made the combined affairs at both locations out to be a mere conventicle but, by assessing the records, Newton concluded that it was orthodox, authentic, and at least as big as the Council of Nicæa:

> For the designe of this Council being very great it needed great credit & authority to support it. They were not only to examin the <cause> of Athanasius but also to receive into communion Arius & Euzoius wth their followers in Egypt as men who had been opprest by a fals representation of their faith: & it was an ancient Canon of y^{e} Church, as well as a necessary one, that no man should be received by a less number of Bishops than those by w^{ch} he had been ejected.

[48] Bacon, *Life and Actions*, pp. 53–9, esp. 53, 56, 59; Cave, *Ecclesiastici*, pp. 87–90, esp. 90; Barnes, *Athanasius and Constantius*, pp. 23–4.

Constantine had sent out a universal request requiring the attendance of bishops so that it might be full. Newton pointed out that whereas the Eastern bishops had criticised Athanasius for breaking with tradition by being restored by fewer than the number of bishops that had deposed him, Athanasius's supporters had never made the same charge against the Eastern bishops for receiving the Arians at Tyre. Nor, immediately after the council, had the Athanasians criticised it for being insufficiently large.[49]

On top of this, Athanasians criticised the council for being one of the 'Arian' councils, "and on that account of no authority," but, Newton spluttered,

> this accusation was never proved & an accusation wthout proof is of no credit. The accusation indeed has gained credit among y^{e} followers of Athanasius for a long time, but this makes it no more than popular fame & popular fame <wthout original evidence> thô of five thousand years standing is but popular fame nor can any man take up wth it wthout making himself one of y^{e} giddy mobile. Such fame indeed when y^{e} original of it is forgotten may make a strong presumption, but when we know y^{e} original & see y^{t} it was spread abroad wthout evidence can be of no moment. Wise men must look only to y^{e} evidence.

To Newton, the attitude of the Athanasians, apart from being motivated by their usual malice, begged the question. The only evidence that the council was 'Arian' was that it received Arius into communion and banished Athanasius. They received Arius, despite him disowning those things for which he had been condemned ten years earlier, nor did they condemn Athanasius for subscribing to the Nicene decrees. It was the subscribed opinions rather than the men that made a council heretical or not: "So far was this Council from being Arian that the Bishops thereof in almost all their following Councils declared against Arianism & anathematized the opinions for w^{ch} Arius had been condemned." If the accusation was that these same bishops dissembled and "were Arian in their heart while they were orthodox in their language," Newton continued, "I must ask you how you or any man else can know that. For an accusation without knowledge of the thing is that w^{ch} y^{e} world calls clamour calumny & malice. Had Athanasius & his Moncks the guift of searching & knowing men's hearts?" The only way to know a person's faith was by the public and externally visible manner of worship and on these grounds the council was orthodox, constantly condemning Arian positions. Moreover,

> they were never reprehended by their enemies upon any of these heads. Should any Church of our age charge heresy upon any body of men of her own communion, & should the men reply that they always were of y^{e} communion of that Church & always profest her faith & used her worship & <& that they> still continue in that profession & practise; & should y^{e} accusers grant all this & only reply that notwithstanding their communion profession & practise they were

[49] WACL MS, fols 11r and 14r; Keynes MS 10 fol. 5v.

> hereticks in their hearts; & should the Judges upon this accusation condemn them to death: I think such proceedings would by all sober men be accounted as malicious & barbarous as any we ever heard of.

Yet this was the case at Tyre, where Athanasians made baseless accusations against a truly orthodox council.[50]

Newton added that the supporters of Athanasius often complained that the Eusebians dissembled at Nicæa, yet according to their writings this fact had not diminished the authority of that council. Even if they *were* Arians, the authority of a judge depended "not upon his religion or sincerity but upon his incorporation into y^{e} body politick, & upon his Commission to act. And so y^{e} authority of a Council depends not upon the secret religion & sincerity of the men but upon their being in external communion wth the Church catholick, & having a legal commission to meet & act in Council." Unless this were so, we could never be certain that *any* council was authentic. In any case, everyone in this period acknowledged that the council *was* authentic: "For Athanasius & his party in that age questioned not y^{e} authority of this Council, but only complained as if they had abused their authority by corrupt judgment." It was the sincerity and integrity of its participants that were brought into question by contemporaries such as pope Julius and *not* its authority; when the same pope received Athanasius into communion and absolved him, he implicitly accepted the sentence of excommunication passed by Tyre.[51]

Death in the Boghouse

The Arians (or 'Eusebians') were now rampant although orthodox historians gleefully related how Constantine was soon unhappy at the way Arius and his Meletian friends seemed to stir up strife and bloodshed wherever they went. Constantine called a new synod at Constantinople but, before this council, Arius was refused communion by Alexander, the new Bishop of Alexandria. The Emperor, who had asked Arius why he caused so much trouble, once more asked him to reaffirm his faith. Constantine was again satisfied though Bacon remarked that "Historians saith that (to save Arius from a plain lie and perjury) at the same time Arius had his private opinion in his own sence under his own hand in writing, which then he also kept under his arm when he made his oath," and that Arius swore in relation to that. Alone with Macarius, Alexander, under threats from Eusebius and an order from Constantine, stood fast in his resolve not to admit such a heretic to communion and prayed to God to "take Arius away" lest heresy enter the church. According to Cave, Heaven "heard his Prayer and signed a Warrant for the Execution."[52]

[50] WACL MS, fols 12r–13r; Keynes MS 10 fols 6r and 7r.

[51] Keynes MS, 10 fol. 8r–v; WACL MS fol. 13r–v.

[52] Bacon, *Life and Actions*, pp. 60–3, esp. 63; Cave, *Ecclesiastici*, pp. 90–3, esp. 92.

Now Arius and Eusebius of Nicomedia prepared for their triumph, namely the acceptance of the former into communion with the Church. Walking through the streets with what Cave called "a Pompous Train of his Friends and Followers, swelled with the hopes of tomorrow's Triumphs," he came to a place in the market-square where he requested a moment to relieve himself. The more conventional historians could scarce restrain their *schadenfreude* at what happened next. While Cave, following Athanasius's account, explicitly linked Arius's demise to that of Judas Iscariot, Bacon merely remarked that in a place "appointed for such a purpose . . . his excrement and bloud run out, his belly breaks, his guts fall out, his spleen and liver follows." Cave remarked that "*Socrates* and others say, that the Bowels, and all the *Intestina*, with a vast Flux of blood issued out of the Postern passage"; his followers were shocked by this and soon concocted a pack of lies to cover up their hero's sad fate, having "found the Wretch wallowing in his own Filth and Blood." Cave contrasted different stories of this incident and mentioned the versions of Rufinus, Zonaras, and Photius, who had Arius prosper for some years after this but Cave noted that "The Account we have given of it is, that which *Athanasius* assures us, he received from his own Presbyter *Macarius*, then present at *Constantinople*, when the thing was done." The place remained notorious until a rich Arian bought it, knocked it down and built a new dwelling on the site.[53]

In his critique of the authenticity of this tale, Newton drew attention to the dubious circumstances surrounding the death of Arius. The exact nature of his demise was "of no moment" but the description of it

> was not spread abroad till about 24 years after his death, & then it was first vented by his greatest enemy Athanasius in a clandestine way. For Athanasius in y^e^ end of y^e^ reign of Constantius being forced to retire from his bishopric into y^e^ wilderness of Egypt, broached y^e^ story there by sending about a narrative of it in a timorous & cautious manner, charging them not to transcribe it but to return it back to him so soon as they had read it.

This was clear from a letter Athanasius wrote to the monks about the same time in which he mentioned this tale along with events that took place at the end of the 350s. At the same time that this "libel or narrative" concerning Arius's death was promulgated in the wilderness, Serapion wrote to Athanasius asking for the latter's opinion regarding Arius's fate and the reply constituted the chief evidence for the details concerning the event. All this was deeply suspicious as far as Newton was concerned: "the story of Arius's death was first broached by Athanasius at that time when Arianism was countenanced by the Emperor & by all mortals, & by consequence after the compliance of the western Bishops in the Council of Ariminum; & Athanasius pretended no other author for it then Macarius a dead man." Initially he propounded it

[53] Cave, *Ecclesiastici*, pp. 92–3; Bacon, *Life and Actions*, pp. 63–5, esp. 64–5.

"amongst his ignorant & credulous Monks wth much timorousness charging them to return the writings quickly to him, wthout letting any copies be taken least it should at length get into such hands as he could not trust." Later, in the letter to Serapion, when the story was "once spread abroad, so that he might tell it wthout danger of being reputed it's author, he tells it again in his first Oration wthout any such caution."[54]

This made the entire narrative dubious in the extreme. Firstly, the prayer calling for Arius to be taken away "is contrary to y^{e} temper & spirit of true Christianity, & it is not likely that God would heare a wicked prayer." Secondly, the story did not come from the original event at Constantinople but from Egypt "& was not broached there till 24 years after y^{e} death of Arius or above." Deploying his favourite forensic rapier, Newton proceeded to claim that "Athanasius & the Bishops of Egypt when collected in a Council at Alexandria five years after the Council of Tyre knew nothing of it, as you may perceive by the letter w^{ch} that Council wrote in defence of Athanasius against Arius & the Council of Tyre." Pope Julius was ignorant of this account when he defended Athanasius in 341 nor did the Council of Sardica mention it in 343. Athanasius therefore promulgated it first many years later and his spokesmen, the later ecclesiastical historians, "propagated it to posterity." Thirdly, Newton continued, the entire narrative broke the ordinary rules of justice because it "was broached & spread abroad by the grand enemy of Arius without any pretence of proof or other evidence then y^{e} credit of y^{e} reporter. ffor detracting stories never look well when told by profest enemies." For Newton, "Such a person may be an accuser but not a witness, & accusations wthout proof are by the general rule of all courts of justice to be accounted calumnies." Indeed, Athanasius had admitted that the story had been deliberately released to "blast y^{e} name and religion of his enemies" and he had promoted it amongst a group of ignorant and credulous monks. Even then, the story had taken a while to gain acceptance only doing so when the bulk of the ecclesiastical historians wrote their stories in the following century.[55]

Seditious and Christian Characters

After Arius's ignominious death, homoousian Christians hoped that his poisonous doctrine would abate and yet the opposite happened. At Alexandria, according to Cave, "the *Arian* and *Meletian* Party studied all ways to undermine and supplant the Catholicks." While he kept Athanasius in exile,

[54] "Paradoxical Questions concerning the morals and actions of Athanasius and his followers," Keynes MS 10 fols 1r and 3r; an earlier version (MS badly damaged) is at WACL MS fols 1r and 4r. See Barnes, *Athanasius and Constantius*, pp. 133–4.

[55] Keynes MS, 10 fols 3r–v; WACL MS fols 4r–v.

Constantine did try to balance his treatment by banishing John, the Meletian bishop, but for Bacon the Emperor's real proclivities were shown by the fact that he was baptised by the Bishop of Nicomedia—notwithstanding the efforts by Baronius and other modern Catholic historians to claim that he had been baptised by pope Sylvester. Constantine unfortunately reposed his trust in the Arian presbyter who had been the darling of his own sister and, when the Emperor died in 337, his will was passed by this presbyter to his son, Constantius. Tragically, Constantius, who was given control of the Eastern Empire, became the sole Arian sympathiser of the three sons (the other being Constans and Constantine II) and, according to Cave, he despatched his uncles "into another World" when he heard rumours that his father had been poisoned.[56]

For the rest of his life, Athanasius was an irritant to Constantius, who did everything he could to ensure that Arianism triumphed. For example, in early 356 Arians allegedly committed a series of outrages against innocent clerics and lay people. As a result of these outrages, Athanasius hid for six years either (depending on the historian) secreted amongst his flock or safe in the desert wilderness with monks while the doctrines of Arianism, homoianism (the Son is like the Father), and even anomoianism (the Son is *not* like the Father) gained ground. Constantius stained his reputation by his conduct at councils during this period, forcing bishops to subscribe to unorthodox creeds under pain of banishment, excommunication, or worse. Constantius's own death as a rank homoian (having been baptised by Euzoius) in 361 was, for Cave, brought about by a fever caused, at least in part, by his vexation at the internal bickering amongst the Arian factions. For many orthodox historians in the seventeenth century, there was ambivalence about Constantius as a Christian ruler. Cave gave some thought to his character, judging him to be "a Prince of lofty Mind, careful to preserve the *decorum* of State and Empire, a rigid Exactor of Discipline, especially in Military Matters." He was also "a great Master of those private Vertues that adorn a Prince, sober, chast, and temperate, kind and bountiful to his Friends and Followers, but of a Temper inclin'd to Cruelty, especially where there was a least Suspition of attempting the Empire." Unfortunately, he allowed flatterers to take up the major offices in the kingdom, people who did innumerable misdeeds under his authority. Understanding little of the disputes that were conducted in the synods that he convened, "he was Superstitious rather than Religious, corrupting Christianity, in itself a most simple and absolute Religion." His own inability to grasp the nuances of debate was disastrous, and it "laid him open to all the Impostures and Insinuations of the *Arian* Party, who fed his humor, and abus'd his Power, whereby they stain'd his Reign with the Blood and Ruine of more Catholick Christians, then perhaps had suffered under any one

[56] Cave, *Ecclesiastici*, pp. 93–4; Bacon, *Life and Actions*, pp. 66–77., esp. 68

Heathen Emperor." Yet historians such as Gregory Nazianzen reported that on his deathbed he repented many of the things done during his reign, such as killing so many of his people and promoting religious innovations.[57]

For Newton, it was Arian sympathizers who had been the victims of persecution, and the character of Constantius was unblemished. Not so that of Athanasius. Newton cited Sozomen to the effect that everyone at Tyre had accused him of gaining his bishopric by perjury and added evidence from Socrates and Eusebius of Caesarea that the status of *homoousios* had been a burning issue after the Council of Nicæa had ended in mutual accusations of Sabellianism and tritheism. From Sozomen and Philostorgius Newton gleaned that a charge had been made against Athanasius's conduct on the death of Alexander, bishop of Alexandria. Despite a sworn agreement amongst the local bishops that Alexander's successor would be appointed by common consent and that the process would not commence until these disputes had been settled:

> Athanasius wth a part of y^{e} people rushing one evening into y^{e} Church called Dionysius's, & finding there certain Bishops shut y^{e} doors & caused y^{e} Bishops after much reluctance to ordain him. Whereupon y^{e} rest of y^{e} Bishops anathematized Athanasius, but he sending letters in y^{e} name of y^{e} City to y^{e} Emperor procured a confirmation of his ordination & thereby silenced his adversaries.

According to Newton, evidence from his own defence offered by Athanasius at the Council of Alexandria in 338, betrayed his guilt on this score. While Athanasius denied the charge of secretly procuring a small number of bishops to secure his ordination, his plea that it had been approved by popular acclamation, and that the people had kept himself and the bishops holed up in a church, was all the proof Newton required: "Thus you see while this Council would seem to correct the accusation in point of circumstances, they confess the sedition & violence of the people & y^{t} y^{e} imprisoned Bishops resisted them, many days & nights together before they would ordain him." In any case, Newton added, Athanasius was far too young to be ordained nor was he one of the twelve deacons from whom the bishop was supposed to be elected. The death-bed story was obviously a fiction of a later date and the truth lay in Athanasius's Machiavellianism. In the immediate aftermath of Nicæa, Athanasius had "inflamed differences, thereby to throw out part of ye Clergy & make room for himself & his friends" and bided his time until he was elevated to deacon. After that, "the reputation & interest he had got with his friends by that controversy, served him to invade the Bishopric."[58]

More broadly, Athanasius's entire career was steeped in sedition and at various points in his life he was denounced by authorities such as the Council

[57] Cave, *Ecclesiastici*, pp. 138–9, 146–7, and 171–2; Bacon, *Life and Actions*, pp. 169–70.
[58] WACL MS, fol. 28r–v; Keynes MS 10 fol. 20r–v.

of Tyre and by the Emperors Constantine the Great and Constantius. At the Council of Alexandria in 338, Athanasius conspired with other members of the synod and "together with them wrote a letter to all the world, in y^{e} end of w^{ch} Letter they laboured to put all their friends into a tumult against the eastern churches & by consequence against their Emperor." After a lengthy denunciation of the Eastern churches the letter concluded "wth an exhortation to invade & destroy them by open force & violence." When Constantius sent an armed force to displace Athanasius and replace him with George ("for Athanasius & his party would never yeild to any thing but force") he shut himself in a church with his supporters and then burned the place down. Athanasius blamed this on George but Newton remarked: "whether the Gregorians burnt a Church & defac't an altar they were to use themselves & must repair or the Athanasians defaced & burnt what they could use no longer, I leave to y^{e} Readers judgment."[59]

According to Athanasius, in the reign of Constantius, not long after the anti-Athanasian Councils of Arles (353/4) and Milan (355), the imperial *notarius*, Diogenes, came to Alexandria and "forced Athanasius from the City & made a sharp war upon his Clergy." However, "when the people of Alexandria resumed courage, this messenger also seing the people prepared to fight returned without compassing his message." Sozomen recorded that, at the start of 356, a larger body of troops, under the leadership of Syrianus, entered a church called Theonas but failed to find Athanasius there: as far as Newton could discern,

> Athanasius represents that he & his people were passing the night together in devotion but by a Letter w^{ch} they wrote four days after (viz^{t} y^{e} last day of January) to all the people under Athanasius to stirr them up to their assistance, I find that they resisted the soldiers & by consequence were armed to guard their Bishop & that they kept the Church by force & there hung up the arms of the vanquished soldiers in triumph.

Although Athanasius's letter told of a terrible slaughter of clerics and virgins, for Newton it was more accurately "a notable instance of the seditious spirit of Athanasius & his followers."[60]

These atrocities—which Newton called "broiles"—against the orthodox in Alexandria were recorded in two books critical of Constantius by Lucifer of Calaris and Hilary, both of which Newton denounced as "railing." In the latter, he went on, one could read how it was that "these stirs" were not "of short continuance. ffor Athanasius exclaiming against the proceedings of Constantius as a vehement persecution & celebrating all those who were slain or taken prisoners, as martyrs & Confessors, plaid the trumpeter to the

[59] Keynes MS, 10 fol. 24r–v; WACL MS fols 32r–v, 33r.

[60] Keynes MS, 10 fol. 26r; WACL MS fols 33v and 52r–v; Barnes, *Athanasius and Constantius*, pp. 118–20.

rebellion & kept it up for a good while." Constantius was driven to describe Athanasius as ascended from "y^{e} lowermost hell" and went on to describe his "most foule crimes for w^{ch} he can never be sufficiently punished no not tho he should be ten times killed." When Valens took over, according to Newton, he found the Egyptians "were so seditious that afterwards when [he] would have expelled Athanasius he could not effect it but found it necessary to desist. For it was not Alexandria alone but all Egypt & Libya w^{ch} was inflamed by this sedition the people with their Bishops & Presbyters being every where stirred up by the above mentioned Letter of the Alexandrians." This was the truth but Athanasius's account provided only a nauseatingly false gloss, "palliat[ing] & sanctify[ing] these seditions as if his party were assembled out of all Egypt & Libya with so many Bishops & kept the feild in a great body together for no other end but to pray on Sundays, & as if the Roman Legions came armed to conquer nothing but women & children. But this is his poetical way of talking in all his writings."[61]

It remained to assess the conduct of Constantius, reviled as a persecutor by almost all orthodox historians since Athanasius. Did he persecute the homousians for their religious orthodoxy? Or for their seditious actions alone? The answer was, perhaps, unsurprising although the evidence was tendentious. In his letter to those leading the solitary life, i.e. the monks, Athanasius recorded how his enemies had resorted to forging criminal accusations against his own allies in addition to the well known charges that had been repeatedly raised against himself since before Tyre. To Newton, passages in the letter "<sufficiently> shew that the best of Athanasius's martyrs & confessors suffered as evil doers & seditious persons, & that Constantius & his bishops studiously avoided punishing them for their faith, & that rather then do it they chose to feigne fals accusations if you will beleive Athanasius." Other so-called martyrs lauded by Lucifer of Calaris had died for resisting the state while those who had refused to sign the condemnation of Athanasius at Milan, including pope Liberius, were deposed by councils of their own religion "and suffered not for their faith." According to Newton, they had sought to "keep up a schism between the eastern & western Churches, & so were banished as enemies to peace. They refused to debate upon those matters for w^{ch} the Emperor called the Councils unless they might have their own matters first dispatcht, & so suffered as polyticians for usurping upon the Emperors right."[62]

After the Councils of Ariminum and Seleucia in 359, "Athanasius & his friends falling into a rage at the Emperors success, began to write railing books against him; & Athanasius indeed laboured to perswade the Egyptians that

[61] Keynes MS, 10 fols 27r–v and 28r; WACL MS fol. 52v and 53v–r (sic).
[62] Keynes MS, 10 fols 28v–29r; WACL MS fols 34r–35r.

the Emperor overcame the western bishops by tyrannical asperity & terror; & yet the contrary is certainly true." Hilary, for example, "in a railing book w^{ch} he wrote at that very time against the Emperor attributes the success to his clemency." In the same breath, Hilary slated Constantius "as the most cruel of persecutors, & yet declare[d] that this consisted in nothing but love & kindness. By this means he had better success then the heathen persecutors by violence, & therefore was in Hilary's opinion more cruel, not to the bodies but to the souls of men." From Baronius, Newton found that Hilary had presented his book to Constantius at Constantinople in 360, hoping to die as a martyr and "fix the name of persecutor" on Constantius: "But altho this railery was crimen læsæ majestatis, & in that government punishable with death: yet the Emperor was so far from being provoked to do any thing which might but look like persecution that on the contrary he thereupon released Hilary out of banishment & licensed him to return home into Gallia, thus endeavouring to overcome evil with good." Even Gregory Nazianzen had a good word to say about the Emperor and Newton commented that this testimony "coming freely from the mouth of an enemy & an eye-witness of things, is as great as can be desired."[63]

For Newton, Constantius was exactly the opposite of the negative images of him provided by Hilary and Lucifer and the antithesis of Athanasius's portrayal in his *History of the Arians* as the persecuting Antichristian Emperor who presided over a series of heretical and diabolical councils. On the contrary, Newton outdid himself in a remarkably positive evaluation of his hero: "the vertues of this Emperor were so illustrious that I do not find a better character given of any Prince for clemency, temperance, chastity, contempt of popular fame, affection to Christianity, justice, prudence, princely carriage & good government, then is given to him even by his very enemies." He retained his imperial dignity but nevertheless "reigned in the hearts of his people, & swayed the world by their love to him, so that no Prince could be farther from deserving the name of a persecutor." There was the tiny matter of murdering his uncles, and he been uncompromisingly overzealous in pursuing his victory over Magnentius, but "he did the first because they poisoned his father & the last to secure not himself but Christianity from the attempts of the heathens." Apart from these blemishes on his curriculum vitae, even his enemies agreed in praising his virtues: "All these witnesses lived in the reign of this Emperor & therefore knew what they wrote, & being his enemies would not favour him. ffor they wrote after his death, & so were at liberty to speak their minds. And therefore if any later author affirms y^{e} contrary he ought to be corrected."[64]

[63] Keynes MS, 10 fols 29r–v and 30r–31r; WACL MS fols 35r, 36r–v, 37r.
[64] Keynes MS, 10 fols 30v–31r; WACL MS fol. 37v.

Conclusion

The character of Athanasius revealed by Newton's investigations was that of a seditious, lying, and antichristian corrupter. Fatefully, Athanasius cavorted with the freakish "monks of the wilderness" and rewrote history during his exile in the late 350s and early 360s in which he created the most despicable and diabolical fraud that the world had seen. With the help of the civil power and the authority of the Church of Rome, Athanasius helped inaugurate the dominance of the Mystery of Iniquity that Newton believed had held sway until his own time. Newton's own exegetical enterprise, designed to unravel the evil effects perpetrated by his *bête noire*, functioned at a number of levels. The litigious and empirical presentation offered in "Paradoxical Questions" rested on a hatred of persecution, an immersion in prophecy, and a deep-seated commitment to an easily comprehensible version of Christianity. Naturally, Newton's exegetical techniques were employed to show that the early church, and indeed the godly persecuted by the Athanasians, shared exactly the same doctrinal and political views that he did. This critique was also bound up with a set of political and epistemological presuppositions that have not previously received historical attention. Newton held that while a state religion was desirable for maintaining order and promoting charity, it ought to encompass or tolerate a wide range of beliefs. The civil magistrate could not know or affect "men's hearts" and merely showed itself to be unchristian and persecutory if it tried to do so. On the other hand, it was foretold in prophecy that the godly would be vexed and harassed by the ungodly.

Newton's own version of history, while depending on the same categories for example, of harassment, clemency, obfuscation, and sedition as those of Bacon, Cave and other Anglican apologists, was a mirror-image of those of his enemies. Doctrinally, Newton's anti-hero was, of course, Athanasius but for an unreservedly positive evaluation of character he turn to Constantius, the gentle, godly prince who showed how a Christian Emperor might rule with the sword and yet avoid persecuting his enemies for religious reasons. Historically, doctrine and Christian demeanour were inextricably linked as were their opposites. His early church persecutors were the saints of the orthodox, while Catholics and Protestants conspired in order to pillory Newton's own heroes for similar crimes. This dualist form of saint/martyr versus idolator/persecutor was taken from the prophetic texts of the New Testament but it was also the living language by which High Church (and often Low Church) Anglicans routinely denounced dissenters and vice versa in the late seventeenth century.

In considering why Newton composed the "Paradoxical Questions," it is worth pointing out that we know little of its circulation other than that it was almost certainly perused by William Whiston in the early eighteenth century. As with many of Newton's theological writings, his 'reader' does not seem to

have been anyone whom he might have trusted or who might even have existed during his lifetime. It was the private duty of a learned Christian to read the Bible and the patristics, not merely to learn how to lead a moral life, but also to grasp how Christianity could function as a state religion and how it had not done so. Having donned a metaphorical wig, Newton also saw it as his duty to try religious wrongdoers and convict them of the vast number of crimes of which they were guilty. This general approach was no different from that taken by any other contemporary, yet Newton's guilty men were the heroes of orthodoxy. Newton's seventeenth-century writings, while seldom clear about the exact nature of the Christian state, imply by criticism of its opposite that a godly state was possible in which the state religion was almost certainly not the most doctrinally authentic. For the antitrinitarian credal minimalist, charity and neighbourliness came above specifics of faith and one might live and study in a virtuous if doctrinally misguided Christian state that did not persecute the true believers. Whether late seventeenth-century England appeared to Newton to be such a state was doubtful.

Appendix: Emperors, Creeds, and Councils, 325–81 (Councils in Italics)

303 Persecution of Christians in Nicomedia and then all of East under Diocletian (who abdicates in 305) and his *Caesar*, Galerius, who intensifies the persecution.

306 Constantine proclaimed Emperor of the West in York.

312 Constantine gains power in the West after appealing to the Christian God.

313 Constantine and the pagan, Licinius, Emperor in the East, agree to a policy of religious toleration.

318 Arius is marked out as preaching heretical opinions in Egypt.

324 Constantine defeats Licinius to become supreme Emperor.

325 *Nicæa (Iznik)*—The Nicene Creed, which includes the anti-Arian doctrine that the Son is consubstantial (*homoousios*) with the Father, is adopted. Arius and others are banished.

328 Athanasius succeeds Alexander as Bishop of Alexandria. Arius and his supporters, Eusebius and Theognis, return from banishment.

330 Constantinople is created as centre of eastern empire.

332 Athanasius is accused of death of Arsenius.

335 *Tyre and Jerusalem*—At Tyre, Athanasius is exiled to Trier as a result of serious accusations of wrongdoing.

336 *Constantinople*—Arius dies, according to Athanasius, just before he was about to be restored by this council.

337 Constantine dies; Constantine II (in theWest), Constans (in Italy and N. Africa, anti-Arian), and Constantius (in the East, influenced by Eusebius of Nicomedia, a pro-Arian) take over; Athanasius released from banishment by Constantine II.

338 *Alexandria*—A council is arranged by Athanasius which is sympathetic to him.

340 Constantine II is defeated by Constans who becomes ruler of West; Athanasius is welcomed to communion in Rome by Pope Julius

341 *Antioch*—The Greek bishops deny that they are pro-Arian while they condemn efforts to make Rome a superior court of appeal and criticize what they take to be the Western position (Sabellianism) according to which the three persons of the Godhead are modes of one being. In turn, western bishops criticise eastern bishops for tritheism on the grounds that they hold to three (distinct) *hypostases*, translated into Latin as three *substantiae*.

343 *Serdica (Sofia)*—This council is called by the leaders of East and West in 342 but splits into a division of bishops from each side; in a manifesto, the western council denounces renegade bishops (Valens of Mursa and Ursacius of Singidunum) ostensibly under their own sphere of influence and delivers a proto-Sabellian document.

343 *Philippopolis*—This meeting of eastern bishops is held at approximately the same time as Serdica. These eastern bishops anathematise the views of Arius, refuse to sit with the western bishops, and condemn a number of westerners including Athanasius and Pope Julius.

344 *Antioch*—The compromise 'long creed' is composed by eastern bishops which avoids *ousia* language and denies that the Son is a different *hypostasis* from the Father.

345 *Milan*—Valens of Mursa and Ursacius, both in territories controlled by Constans, attempt to make peace with western bishops by denouncing the Arian heresy.

345–6 Under strong pressure from Constans, Athanasius is readmitted by Constantius to Alexandria.

347 *Rome*—This council of western bishops is attended by Valens of Mursa and Ursacius who declare that all the accusations they had ever made against Athanasius were false.

349 *Antioch*—A council which condemns and deposes Athanasius despite possessing a version of Athanasius's *Defence against the Arians*. The deposition is soon annulled.

350 Constans is murdered by the 'tyrant' Magnentius. Athanasius is later accused of having written to the usurper to curry favour.

350–1 Ursacius and Valens of Mursa withdraw their charges.

351 *Sirmium*—This council condemns Athanasius (who is again deposed.)

352 Athanasius writes *On the Council of Nicæa*.

352–3 Magnentius defeated by Constantius who becomes the sole Emperor.

353/4 *Arles*—At this council, Constantius, now strongly supported by bishop Valens, ensures that the mainly Eastern bishops denounce Athanasius.

355 *Milan*—Athanasius is condemned once more, again by a council packed with Eastern bishops. Those exiled for not subscribing to this condemnation include Lucifer of Calaris, Hilary of Poitiers, and Pope Liberius.

356 Athanasius is forcibly exiled and flees to the desert. He is replaced in the see of Alexandria by the radical Arian, George.

357 *Sirmium*—At this council, the so-called (by Hilary) "Blasphemy of Sirmium," a theological manifesto proclaiming that the Father is unquestionably greater than the Son, is proclaimed. Hosius of Cordoba, architect of the *homoousios* solution at Nicæa, is allegedly forced by Constantius (thanks to the influence of Valens of Mursa) to denounce both *homoousios* and *homoiousios* (i.e. that the Son is *like* the Father *in essence.*) Valens is opposed to use of *ousia* language and wants only to proclaim that the Son is 'like' the Father.

At the same time, Eudoxius becomes bishop of Antioch. Following the logician, Aetius, and the latter's pupil, Eunomius, he holds the Anomoian ('dissimilarian') position that the Son is *not* like the Father, i.e., a view opposed to both *homoousios* and to *homoiousios*. The Anomoian view is, by now, the generally accepted eastern position and was promoted by men such as Basil of Ancyra. However, after Sirmium, Basil temporarily convinces Constantius that *homoiousios* is the only way to remain true to the faith and save church unity. Even the exiled Pope Liberius agrees to subscribe.

At about this time, Athanasius adds substantially to his *Defence before Constantius* (orig. composed ca. 353) and also composes his *Defence of his Flight*, in which he claims he is being persecuted, and his *History of the Arians*, in which he condemns Arius and denounces Constantius as Antichrist.

359 *Ariminum (Rimini)* and *Seleucia (Silifke)*—A universal council held in two locations. Valens of Mursa convinces the Western bishops to assent to an Arianised interpretation of the Creed and, according to Jerome, as a result of Rimini, "the world groaned to find itself Arian." Basil loses Constantius's confidence and Eudoxius becomes bishop of Constantinople the following year.

360 *Constantinople*—The supposed compromise 'homoian creed' resulting from this council declares merely that the Son is 'like' the Father; the council is not prepared to stomach the anomoianism of Aetius. Athanasius now sets out to create an alliance with Basil, whom he believes accepts the Nicene creed despite the latter's concerns over *homoousios*, and in late 359 and late 361 writes *On the Councils of Ariminum and Seleucia* as an olive-branch to the *homoiousians*.

Hilary, now an ally of Athanasius (despite praising the creeds of the 'Dedication Council' of 341, the eastern creed of Serdica in 343, and that of Sirmium of 351) lambasts Constantius as a persecuting and deceitful tyrant in *Against Constantius*.

361 Constantius dies. Julian the Apostate becomes Emperor and revives paganism.

362 *Alexandria*—Athanasius is permitted to return from the desert and follows Basil in making a distinction between *ousia* and *hypostasis*, the former alone being common to all three persons of the Godhead.

363 Julian is succeeded by Jovian, a pro-Athanasian, who dies after a short time. In turn he is replaced by Valentinian.

364 Valentinian becomes Emperor but soon gives the eastern half of the empire to Valens, a pro-Arian. Valens supports and is advised by Eudoxius until the latter's death in 370.

373 Death of Athanasius.

378 Death of Valens in battle against the Goths. Valens is succeeded by Theodosius, who sets out to restablish the Nicene Creed.

381 *Constantinople*—Theodosius calls for a general council. It reaffirms *homoousios*.

ESSAY 8

Lust, Pride, and Ambition: Isaac Newton and the Devil

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> For all that is in the world, the lust of the flesh, and the lust of the eyes, and the pride of life, is not of the Father, but is of the world. 1 John 2:16

Newton in an Age of Wonders

In his 1668 work *A Blow at Modern Sadducism*, Joseph Glanvill, Fellow of the Royal Society and ardent apologist for belief in witches, demons and ghosts, contended that the denial of the demonic was tantamount to atheism.[1] Those who rejected the literal existence of evil spirits, Glanvill asserted,[2] did

[1] Research for this paper was made possible by a Junior Research Fellowship at Clare College, Cambridge. I gratefully acknowledge the Fondation Martin Bodmer, Geneva; the Jewish National and University Library, Jerusalem; the Provost and Fellows of King's College, Cambridge; the Warden and Fellows of New College, Oxford; and the William Andrews Clark Memorial Library for permission to quote from manuscripts in their archives. In addition, I am grateful to Butterfields Auctioneers for allowing me to quote from the Newton manuscript they sold in Los Angeles on 10 May 2001. Thanks are also due to Ron Finucane, Scott Mandelbrote, Reiner Smolinski, Ian Stewart, Karin Verelst, and Gary Waite for their help and criticism. Surveys of Newton's writings were partly facilitated by the increasing number of transcriptions the Newton Project is making available in electronic format. Transcriptions from the Newton manuscripts represent deletions as strike-outs and insertions are enclosed within angle brackets.

[2] [Joseph Glanvill], *A Blow at Modern Sadducism in some Philosophical Considerations about Witchcraft. To which is added, the Relation of the Fam'd Disturbance by the Drummer, in the House of Mr. John Mompesson: with some Reflections on Drollery, and atheisme. By a member of the Royal Society* (London, 1668), sigs. A5r–v. See also Glanvill, *Saducismus Triumphatus: or, full and plain evidence concerning witches and apparitions. In two parts. The first treating of their possibility, the second of their real existence. By Joseph Glanvil late Chaplain in ordinary to his Majesty, and Fellow of the Royal Society. With a letter of Dr. Henry More on the same subject* (London, 1681). For an overview of Glanvill's project, see Moody

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 155–181.
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so because they did not dare take the next putatively logical step and openly declare that there is no God:

> [I]if any thing were to be much *admired* in an *Age* of *Wonders*, not only of *Nature* (which is a *constant Prodigy*) but of *Men* and *Manners*, it would be to me a matter of *Astonishment*, that *Men*, otherwise *witty* and *ingenious*, are fallen into the conceit that there's *no such thing* as a *Witch* or *Apparition*, but that these are the *creatures* of *Melancholly* and *superstition*, foster'd by *ignorance* and *design*.[3]

But this was not all. Glanvill went on to propose a sinister source for this wicked disbelief, suggesting that the very devil, "whose *influences* they will not allow in Actions ascribed to such Causes, hath a greater hand and interest in their *Proposition* than they are aware of."[4] For since the influence of the Prince of Darkness "is never more *dangerous* than when his *agency* is least *suspected*," in order to accomplish "the *dark* and *hidden designs* he manageth against our Happiness, and our Souls, he cannot expect to advantage himself more, than by insinuating a belief, *That there is no such thing as himself*, but that *fear* and *fancy* make *Devils* now, as they did *Gods* of old."[5] In a few short years, Isaac Newton—then a little-known Cambridge scholar, but soon to be elected Fellow of the Royal Society and eventually rise to the presidency of that august institution—would come under the spell of this diabolical misapprehension.

Newton was not an orthodox theologian. It has long been known that he denied the doctrine of the Trinity, that central pillar of orthodox Christendom,[6] and some of the papers in this volume treat aspects of Newton's anti-Trinitarianism. As long ago as 1728, it was revealed that he also rejected infant baptism in favour of believers' baptism.[7] The recent availability of Newton's theological papers has not only confirmed these heresies, but has brought to light several others as well. In 1991, mortalism was added to the

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E. Prior, "Joseph Glanvill, Witchcraft, and Seventeenth-Century Science," *Modern Philology* 30 (1932), pp. 167–93. For general background on early modern belief in witches and demons, see Keith Thomas, *Religion and the Decline of Magic: Studies in Popular Beliefs in Sixteenth and Seventeenth Century England* (London: Weidenfeld & Nicolson, 1997; orig. publ. 1971) and Stuart Clark, *Thinking with Demons: The Idea of Witchcraft in Early Modern Europe* (Oxford: Clarendon, 1997).

[3] [Glanvill], *A Blow at Modern Sadducism*, p. 2. Further examples of rhetoric that associates disbelief in witches to infidelity or atheism are noted in Prior, "Joseph Glanvill," pp. 178–9.

[4] Ibid., pp. 2–3.

[5] Ibid., p. 3.

[6] On which, see Frank E. Manuel, *The Religion of Isaac Newton* (Oxford: Clarendon, 1974), pp. 57–63; Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge: Cambridge University Press, 1980), pp. 310–20.

[7] William Whiston, *A Collection of Authentick Records belonging to the Old and New Testament* (London, 1728), Part II, pp. 1074–5. This revelation is confirmed by Newton's private manuscripts. See Newton, King's College, Cambridge, Keynes MS 3, pp. 1, 3, 9–11, 23, 31, 43, 44; Keynes MS 6, fol. 1r; Newton, Fondation Martin Bodmer, Geneva, MS, 2, fols 20–22, 26, 34.

list of heresies when James Force demonstrated at a Clark Library conference that Newton denied the orthodox doctrine of the immortality of the soul.[8] In 1996, in another paper given at the Clark Library, Reiner Smolinski backed up Force's work by showing how Newton's mortalism related systematically to other aspects of this theology and prophetic views.[9] If there was one greater heresy than denial of the Trinity or the immortality soul, it was the rejection of the existence of the demonic hordes and the Archfiend himself. In an age when leading members of the Royal Society catalogued case histories of witches, demons and ghosts as evidence for the reality of spirits (in turn used as pivotal proof for the existence of God), denial of evil spirits (as opposed to mere scepticism about particular witchcraft cases) was viewed as beyond the pale of Christianity. Newton's Cambridge colleague Henry More was among those engaged in this project.[10] Those who discounted the ontological reality of these malevolent beings did so against the powerful weight of tradition and the passionate rhetoric of orthodoxy. And yet this is exactly what Newton did. That this should be so of the hallowed icon of the Age of Reason many will find unremarkable. Despite the general drift of some recent historiography, however, this third great heresy of Isaac Newton had nothing to do with any contemporary secularizing trends or incipient rational, but everything to do with the general trajectory of his profoundly biblical faith.

Satan

There are few areas of Newton's theology more difficult than his position on the devil. First, there are diachronic issues to be sorted out, for it is evident that his views on Satan changed over time. Second, because Newton rarely tagged references to the devil in his manuscripts with transparent explanations as to ontological status, when examining such references in isolation it

[8] James E. Force, "The God of Abraham and Isaac (Newton)," *The Books of Nature and Scripture*, ed. James E. Force and Richard H. Popkin (Dordrecht: Kluwer, 1994), 179–200; see also, James E. Force, "'Children of the Resurrection' and 'Children of the Dust': Confronting Mortality and Immortality with Newton and Hume," in *Everything Connects: In Conference with Richard H. Popkin: Essays in his Honor*, ed. James E. Force and David S. Katz (Leiden: Brill, 1999), pp. 119–42.

[9] Smolinski, "The Logic of Millennial Thought: Sir Isaac Newton Among his Contemporaries," in *Newton and Religion: Context, Nature, and Influence*, ed. James E. Force and Richard H. Popkin (Dordrecht: Kluwer, 1999), pp. 259–90.

[10] More, a leading member of the Cambridge Platonists, employed an inductive methodology to demonstrate the existence of evil spirits from the reports of witnesses as part of his programme to develop proofs for the existence of God. The results were published in his *Immortality of the Soul* (1659) and *Antidote to Atheism* (1653.) It is worth noting that More shared Glanvill's position on evil spirits and witchcraft and the editing of the latter's *Sadducismus triumphatus* (1681) is attributed to him. In any case, Glanvill was consciously continuing the project initiated by More. See the *DNB* and especially Sarah Hutton, "The Cambridge Platonists", in *The History of Science and Religion in the Western Tradition: An Encyclopedia*, ed. Gary B. Ferngren (New York: Garland, 2000), pp. 155–7.

is often impossible to determine with absolute certainty if a particular example is meant in a literal or figurative manner. Newton presumably always or nearly always had a clear idea in his own mind what he meant when he employed the terms "the devil" and "Satan" in his private writings; not surprisingly, he rarely saw the need to qualify these terms with explicit markers or even indirect verbal cues. It is thus necessary first to identify the explicit references in his manuscripts and then to reconstruct Newton's theological position on the devil—complete with a probable chronology—in order to infer belief at any given time in Newton's religious career. Frank Manuel was the first to recognize Newton's unorthodoxy on Satan and, in his 1973 Freemantle Lectures he provided a valuable two-paragraph outline of Newton's views on the subject. After more than a decade studying most of the then-available theological manuscripts, Manuel concluded that while Newton as a youth believed in evil spirits, and continued to present a literal devil in his prophetic manuscripts of the 1670s and 1680s, by the conclusion of the seventeenth century and certainly in the early eighteenth century, with allowances for the occasional possible recrudescence of youthful superstitions, "the devil seems to have been metamorphosed into a symbol for lusts of the flesh and his reality becomes far more questionable."[11] Using a manuscript corpus that is now larger than that available to Manuel, it is possible to expand upon this general schema.

Newton's vast prophetic treatises, which include his expositions of such prophetic symbols as the Great Red Dragon of Revelation 12, provide a starting point. Because in seventeenth-century English Protestant prophetic interpretation the Dragon is represented as inspired by Satan, this symbol offers a convenient exegetical litmus test for belief in the devil. Is the Dragon emblematic of both pagan Rome and the devil who uses the empire as his instrument to oppress and corrupt the Church, or does the Dragon refer univocally to Rome and hence not at all to a supernatural fallen angel? In his earliest prophetic writings, Newton, like his Protestant contemporaries, appears to have taken the former view. In Newton's long 1670s treatise on Revelation, the "old serpent" is the literal Satan. Citing an oriental source on dream symbolism, Newton concluded that "y^{e} Apocalyptic Dragon is a very proper emblem as well of y^{e} Roman Emperors & Empire w^{ch} was so great an enemy to y^{e} church as of y^{e} Devil that arch-enemy to mankind."[12] The Great Red Dragon of Revelation 12, Newton wrote, "has a double signification: he is taken for y^{e} Devil ~~y^{t}~~ wth his worship Gen 3 & for a kingdome," for he is not only referred to

[11] Manuel, *Religion of Newton*, pp. 63–4 (quotation from p. 64.) Manuel earlier wrote briefly about the banishment of demons from Newton's theology in his *Isaac Newton, Historian* (Cambridge, Mass.: Belknap, 1963), pp. 149–50. Very little on this aspect of Newton's beliefs has been published since.

[12] Newton, Jewish National and University Library, Jerusalem, Yahuda MS 1.1a, fol. 38r; Yahuda MS 1.1b, fol. 16r.

as "that old Serpent y^{e} Devil & Satan w^{ch} deceiveth y^{e} whole world," but is also represented as having seven crowns upon his seven heads—symbols of rule and dominion.[13] In another manuscript dating from the 1670s or early 1680s, Newton comments on the relatively low number of Gentile converts in the early centuries of Christianity and concludes: "On this the Devil plaid a cunning game in keeping y^{e} heathens from conversion whilst Christianity reteind it's purity."[14] Once again, the language points to the literal, personal devil of traditional Catholicism and Protestantism.

In contrast, the symbol of the Dragon is given no such "double signification" of a heathen empire backed by Satan in Newton's later writings on Revelation. In his "Language of the Prophets," which dates from the latter half of the first decade of the eighteenth century, Newton glosses the relevant text from Revelation 12 in the following way:

> And there appeared another wonder in heaven, & behold a great red Dragon [the Roman heathen Empire] having seven heads & ten horns & seven crowns upon his heads. This Dragon being the old serpent called the Devil & Satan, is that Devil who hath his seat in Pergamus, that is the Greek empire in the reign of the last horn of Daniel's He Goat.[15]

In another place later in the same manuscript, Newton identifies "the Dragon that old Serpent called the Devil & Satan" straightforwardly as "the heathen Roman Empire in respect to its religion."[16] At the conclusion of this writing the Dragon is described as being "at p^{re}sent . . . y^{e} Turkish Empire" and then later in the same sentence simply as the "the Dragon or spirit of error."[17] That is to say, a "spirit of error" was at work within that empire.[18] A literal devil does not now appear in Newton's apocalyptic system.

The single signification Newton later gave to the Dragon of Revelation 12 can be compared with the commentary of Joseph Mede, who in the early seventeenth century wrote what became the archetypal historicist interpretation of Revelation. In his exposition, Mede clearly describes Satan and his

[13] Newton, Yahuda MS 1.2, fol. 11r.

[14] Newton, Yahuda MS 10.2, fol. 15v.

[15] Newton, Keynes MS 5, fol. 19r.

[16] Newton, Keynes MS 5, fol. 48r. Similarly, Newton identifies Lucifer in the prophetic dirge of Isaiah 14, another helpful litmus test for belief in the devil, not as Satan, or as Satan working through the King of Babylon, but simply as the King of Babylon (Newton, Keynes MS 5, fol. 98r.)

[17] Newton, Keynes MS 5, fol. 138r. Newton also equates the Dragon with the spirit of error in Yahuda MS 6, another prophetic manuscript from the early eighteenth century (Newton, Yahuda MS 6, fol. 3r.).

[18] Newton's reduction of devil language in the Apocalypse to a single signification fits into of a broader interpretative trend in his writings of the reduction of the symbolic to the mundane. This feature of Newton's hermeneutics was first noted by Manuel in his *Isaac Newton, Historian*, p. 149. Although mundane (human, political etc.) interpretations of apocalyptic symbols are also seen in the writings of other historicist commentators like Mede, Newton applied this method in a more thorough-going way by extending it to the language of Satan.

angels as *inspiring* the apocalyptic Dragon.[19] Similarly, Newton's one-time disciple William Whiston sees behind the Dragon a literal devil, "who was the main Supporter and Upholder of that *Pagan* Empire in its ancient Idolatry and Persecution."[20] For both Mede and Whiston, along with the early Newton, a real, personal devil incites the pagan Roman Empire; in Newton's later writings, the terms "devil" and "Satan" are merely symbols for this same Empire. Comparisons of his statements on the devil in his prophetic manuscripts help suggest a loose chronology for Newton's movement away from a literal belief. Nevertheless, this prophetic material is extremely tricky to work through and on its own is not sufficient to establish Newton's position *vis-à-vis* the devil.

I will now therefore turn to evidence of a more straightforward nature. The first example of this kind comes from another prophetic manuscript, Yahuda MS 9, which dates from the mid-to late 1680s and thus helps establish a *terminus a quo* for Newton's departure from the orthodox view. In this manuscript Newton moves beyond mere description to conscious explication. The first reference to a serpent in the Bible is found in the account of the first human sin committed in the Garden of Eden, and it is to this account that Newton turns when tracing the origin of the serpentine imagery of the "spirit of error." Newton saw the serpent that tempted Eve to eat the fruit of the Tree of the Knowledge of Good and Evil as symbolic of the fleshly lust for her husband that filled her heart. The forbidden fruit itself stands for both the temptation and the temptation acted upon, for Eve "lusted first & tempted Adam . . . & . . . this is represented by her eating & giving him to eat, the eating signifying as well the lust as the external act."[21] The impulse to temptation, however, is represented by the serpent in the account. Thus, Newton goes on:

> A Dragon or serpent, if called y^{e} old serpent or y^{e} Devil signifies the spirit of error delusion & inordinate affections reigning in the world. ffor spirits good or evil are sometimes put for the tempers dispositions & persuasions of mens minds ⟨much after y^{e} manner that we often take death for a substance.⟩.[22]

Then, after quoting the passage from 1 John 4 that speaks about the need to "try the spirits," Newton argues:

> The spirits of God of fals Prophets & of Antichrist are [in 1 John 4] plainly taken not for any substantial Spirits but for y^{e} good or evil dispositions & true or fals perswasions of mens minds; & the spirits of all men who confess not that Jesus Christ is come in the flesh is called in the singular number the spirit of Antichrist, & said to be come into the world as if it were an evil spirit w^{ch}

[19] Mede, *The Key of the Revelation, Searched and Demonstrated out of the Naturall and Proper Charecters* [sic] *of the Visions* (London, 1643), Part 2, pp. 51–2.

[20] Whiston, *An Essay on the Revelation of St. John, so far as concerns the Past and Present Times* (London, 1744), p. 245.

[21] Newton, Yahuda MS 9.1, fol. 19v.

[22] Ibid., fols 19v–20v.

> was to reign therein & deceive all the followers of Antichrist. And such an evil spirit is the Dragon in the Apocalyps.[23]

Thus, the Dragon of Revelation is a spirit of deception, not a spirit being. One of Newton's fundamental principles of biblical hermeneutics, set down in his 1670s treatise on Revelation, was that the meaning of scriptural images must be consistent.[24] It was possibly in large part on this basis then, that, referring to Revelation 20, he reasons that:

> By this Devils being cast into the bottomless pit ⟨& shut up⟩ that he should deceive the nations no more for a thousand years you may know that he is the spirit of delusion reigning in the hearts of men & by his being there called the old Serpent you may know that he is that same Serpent w^{ch} deceived Eve.

And then, alluding to the proto-Evangelium of Genesis 3:15 and thus emphasizing the continuity of this theme in the Bible, he writes: "For that old serpent was to continue till y^{e} seed of the woman should bruise his head, that is till Christ should vanquish & stay him".[25] A few lines later he confidently concludes that:

> the old Serpent was no more a real serpent then y^{e} Dragon in y^{e} Apocalyps is a real Dragon or then the Beasts in John & Daniel are real Beasts. Tis only a symbol ~~?~~of the spirit of delusion & therefore ~~must be the sentence~~ ⟨y^{e}⟩ curs of this serpent for deceiving Eve must be interpreted accordingly.[26]

The symbol of the serpent was consistent from Genesis to Revelation.

Newton's eventual desire to avoid double significations applied also to his position on the imagery of the Edenic serpent. The orthodox position of a literal Satan behind a literal serpent made no sense to Newton because this would mean that the serpent was punished for the fault of the devil and "⟨to⟩ make y^{e} signe suffer in a litteral sense for the crime of the thing signified . . . is absurd & unagreeable to the nature & Designe of Parables." Instead, Newton continues:

> When the ancient ~~s~~⟨S⟩ages ~~proposed~~ ⟨would have⟩ one thing to be represented by another, they framed a Metamorphosis of the one into the other, & thence came all the ancient Metamorphoses recited by Ovid & others. This was their way of making Parables, & Moses in this Parable of the Serpent speaks in the language of y^{e} ancient ~~sages~~ wise men, being skilled in all the learning of the Egyptians.[27]

The starting point for Newton's heterodox interpretation of the Dragon in Revelation, then, was his belief that the serpent that tempted Eve in the Garden

[23] Ibid., fol. 20v.
[24] Newton, Yahuda MS 1.1a, fol. 12r.
[25] Newton, Yahuda MS 9.1, fol. 20v.
[26] Ibid., fol. 20v.
[27] Ibid., fol. 21v.

of Eden was itself a graphic emblem of the "spirit of delusion." The same spirit has been at work in mankind's affairs—at both the personal and collective levels—since the beginning of human history. And so, by sometime in the 1680s, Satan for Newton had been transformed from an angel of darkness into a symbol for the spirit of error.

Demons

Newton's views on demons follow a similar pattern. The traditional Christian conception of demons holds that they are fallen angels subordinate to the chief fallen angel, Satan. Not so with Newton. As with his view on the devil, Newton began to dismiss the reality of demons beginning in the 1680s. Yahuda MS 9, the same document in which Newton treats the devil as a symbol of the "spirit of error," demonstrates this:

> From this figure of putting serpents for spirits & spirits or Daemons for distempers of y^{e} mind, came y^{e} vulgar opinion of y^{e} Jews & other eastern nations that mad men & lunaticks were possessed with evil spirits or Daemons. Whence Christ seems to have used this language not only as Prophet but also in compliance wth y^{e} Jews way of speaking: so y^{t} when he is said to cast out Devils ~~it cannot be known by this phra~~ those Devils may be ~~nothing but~~ diseases unles it can be proved by the circumstances that they are ~~sp~~ substantial spirits.[28]

In a 1692 letter to John Locke (which helps date his move to an accommodationist approach), Newton wrote that the language of casting out demons "was ye language of ye ancients for curing Lunatics."[29] For Newton, therefore, demons were figures for disordered psychotic states.[30]

The cases of demon-possession in the Synoptic Gospels do not describe the activity of literal devils, but instead reflect the (mistaken) beliefs of first-century Jews. Newton presents a similar argument in his manuscript ecclesiastical history "Of the Church":

> If Moses saith: There shall be not be found among you any one that useth divination, or an observer of times, [that is, of days lucky & unlucky,] or an enchanter, or a witch, or a consulter wth familiar spirits, or a wizzard, or a necromancer: for because of these things the Lord thy God doth drive the nations out ⟨from⟩ before thee: ~~???~~ ⟨superstitious people⟩ are apt here to understand ⟨by these names⟩ such men & weomen as have a metaphysical power of divining, inchanting, bewitching, conversing with spirits, conjuring, & raising up the souls of the dead: whereas these names are to be understood only in a

[28] Ibid., fol. 21v.

[29] Newton to Locke, 3 May 1692, *The Correspondence of Isaac Newton,* ed. H. W. Turnbull (Cambridge: Cambridge University Press, 1961), 3:214.

[30] Newton's reduction of demon language from that of demons afflicting madmen to a single sense that leaves only a human with a diseased mind reveals a structural hermeneutic affinity to his reduction of the devil in the Apocalypse and elsewhere to a single signification.

> moral sense for ~~seducers~~ ⟨deceivers⟩, such as falsly pretend to a power of doing these things and thereby delude the people & seduce them to put their trust in ⟨divinations by⟩ imaginary spirits ghosts & dæmons w^{ch} is a superstition tending to idolatry.[31]

Newton goes on to say that:

> to beleive that men or weomen can really divine, charm, inchant, bewitch or converse with spirits is a superstition of the same nature wth beleiving [sic] that the idols of the gentils were not vanities but had spirits really seated in them.[32]

We have already seen that Newton believed that forsaking the devil was synonymous with rejecting false gods and "all manner of idolatry." The above passage shows that he also made an association between demons and idols, albeit of a different nature. Newton's study of demonology was a subset of his larger project on idolatry. For Newton belief in activity by evil spirits is equivalent to the conviction that the false gods or idols of the pagans were real, independent beings; both positions are equally untrue. There is no ambiguity in Newton's position on the reality of idols; in one manuscript he declares flatly: "An Idol is nothing in the world, a vanity, ⟨a lye⟩ a fictitious power."[33] Newton shared with traditional exegesis the identification of the false gods of the Old Testament with demons.[34] He departed radically from the traditional view in concluding that neither demons nor pagan idols exist.

Ghosts

A long line of Christian tradition with roots in Jewish intertestamental pseudepigraphal literature solved the problem of the origin of New Testament demons by contending that they, like Satan himself, were fallen angels. Newton, on the other hand, adhered to a minority position that associated demons with departed spirits—one of the ways the Greek term δαιμόνιον (*daimonion*) was used in antiquity. It is likely that the starting point for the development of Newton's view on demons *qua* departed spirits was Joseph Mede's posthumous *Apostasy of the Latter Times*, a full-length study in which the Cambridge polymath identified one of the chief apostasies of the Roman Church as the invocation of saints.[35] Interpreting the genitive in the phrase "doctrines of devils" in 1 Timothy 4:1 as objective rather than subjective, Mede argued that

[31] Newton, Bodmer MS, 5A, fol. 8v.

[32] Ibid.

[33] Newton, Keynes MS 7, p. 2. The first two of the four descriptions of idols Newton gives here are from the Bible: 1 Corinthians 8:4 (*cf.* Isaiah 41:24); Jeremiah 8:19, 10:15, 14:22, 18:15, 51:18.

[34] A memorable example of this tradition is seen in John Milton's *Paradise Lost* and *Paradise Regained*, in which the seventeenth-century poet writes at length of Satan's demonic minions masquerading as such Old Testament era pagan deities as Baal, Beelzebub and Ashteroth (*e.g. Paradise Lost*, 1.75–81).

[35] Mede, *The Apostasy of the Latter Times* (London, 1641.) Newton owned a copy of Mede's works, which contained the *Apostasy.* See John Harrison, *The Library of Isaac Newton* (Cambridge: Cambridge University Press, 1978), item 1053.

in this important prophecy about the rise of Christian apostasy the Apostle Paul was referring to doctrines *about* demons rather than doctrines *originating from* demons.[36] Marshalling historical and philological evidence from classical antiquity, Mede demonstrated that the *daimonia* (lesser deities) of the Gentiles were the false gods of the Bible.[37] These *daimonia* were, by origin, "the deified soules of men after death."[38] The importation of the pagan notion of demons into Christian (read Catholic) theology led to the development of the doctrine of saintly intermediaries, who, after all, are meant to be glorified departed spirits. For Mede, and those who followed his interpretation, "doctrines of demons" meant false teachings about ghosts.

That Newton accepted this view is made plain by his occasional use of the expression "doctrines of ghosts" in place of "doctrines of demons" or "doctrines of devils,"[39] along with his use of ghost as a synonym for demon.[40] As he wrote in one manuscript from his later years, "Devils signified the imaginary Ghosts of dead men whom the heathens worshipped as Gods."[41] Once again, however, Newton's use of this orthodox conception involved a heretical corollary, as these ghosts too are merely "imaginary." In contrast, while it is clear that Mede rejected the Catholic doctrine of intermediation, at no time does he explicitly deny that demons, correctly understood, are real, spiritual beings. Newton laid the blame for the rise of the pagan doctrines about demons in the Church at the door of his ecclesiastical nemesis Athanasius, whom he also saw as responsible for introducing Trinitarianism and the doctrine of the immortality of the soul. In his "Paradoxical questions concerning Athanasius," Newton contends that Athanasius advanced the notion of a conscious existence of the soul in the intermediate state between death and resurrection. This was directly linked to false teachings about demons:

> Athanasius by ~~y~~ making ⟨Antony see⟩ y^{e} soule of Ammon ascend ~~into~~ up to heaven, laid the foundation for introducing ~~among~~ ⟨~~into y^{e} Greek churches~~⟩ ~~the Demonology of y^{e} heathens into Christianity & the Doctrine~~ into y^{e} greek Churches [?] this heathen ~~Philoso~~ doctrine of Dæmons, [?] together wth that Popish one of Purgatory.[42]

Thus Newton's conclusions about the soul and demons tempered his reading of Mede's writings on "doctrines of demons." Moreover, as Reiner Smolinski

[36] Ibid., p. 8.
[37] Ibid., pp. 9–14.
[38] Ibid., p. 14.
[39] See, for example, Newton, Yahuda MS 9.2, fol. 103r; Newton, Bodmer MS, 2, fol. 21r.
[40] One example of this is found in William Andrews Clark Memorial Library, UCLA, Newton, "Paradoxical Questions concerning y^{e} morals & actions of Athanasius & his followers" (**N563M3 P222), fol. 55r.
[41] Newton, New College Oxford MS 361.2, fol. 133r. For other examples, see Newton, Yahuda MS 7.1n, fol. 22r; Newton, Bodmer MS, 5A, fol. 8v; Newton, Keynes MS 3, p. 43; Newton, *Chronology of Ancient kingdoms amended* (London, 1728), p. 160.
[42] Newton, Clark MS, fol. 55r.

has recently shown, the absence of disembodied evil spirits directly impacted on the contours of Newton's interpretation of the Apocalypse.[43] Thus, unlike many other contemporary interpreters, Newton did not characterize the latter-day Gog and Magog as constituting evil spirits or the souls of the damned. Instead, the Gogian host is an army of mortal humans.

Evidence that Newton's disbelief in ghosts had practical outworkings in his daily life, and hence was more than merely an exercise in exegesis, comes from an anecdote recorded by Abraham de la Pryme. In this account, De la Pryme (then a recently-graduated scholar at Cambridge) records an incident he witnessed in May 1694 in which Newton encountered a group of scholars mulling around the door of a house in Cambridge purported to be haunted. On seeing them there assembled, Newton is said to have exclaimed: "Oh! yee fools . . . will you never have any witt, know yee not that all such things are meer cheats and impostures?"[44] Although an off-the-cuff utterance, this pithy reprimand (if genuine) neatly and accurately epitomizes Newton's opinion of all devil belief: the gullible and undiscerning took evil spirits to be real entities; by unspoken implication, wise and considering men understood them to be counterfeits and fictions.[45]

The Demons of Temptation

The logical corollary to Newton's views on evil spirits is that those who claim to be tempted by a personal devil are deluded and provoked by their own fleshly imagination. Newton's "Paradoxical questions concerning Athanasius," an important manuscript held at the Clark Library dating from the early 1690s, makes this clear. In a portion of this manuscript where Newton rails against the abuses of the incipient Catholic monastic system,[46] he writes the following:

> Some are of opinion that the Monks of this age were most holy men: but this is a great prejudice & such a prejudice as judicious men who have read & considered [?] their lives can scarce fall into. ffor they seeme to me to have

[43] Smolinski, "The Logic of Millennial Thought," pp. 287–9.

[44] De la Pryme, entry for 19 May 1694, *The Diary of Abraham de la Pryme, the Yorkshire Antiquary* (London, 1870), p. 42. The ghostly disturbances emanating from this house were later discovered to have been caused by a malicious prankster (pp. 39–42).

[45] Although in other contexts the language used by Newton could be mistaken for that of some curmudgeonly proto-Enlightenment sceptic who rejected all belief, the words credited to Newton ring true and are consistent with the vocabulary of this man of deep faith who abhorred religious fraud. In his private writings, Newton applies the term "cheats" to enchanters, magicians, sorcerers, necromancers and witches who used deception to create the illusion of supernatural powers (Newton, New College, Oxford MS 361.2, fol. 133r.) The expression "imposture," Manuel has noted, was "a strongly pejorative word in [Newton's] religious vocabulary—akin to false prophecy" (Manuel, *Religion of Newton*, p. 45).

[46] On this, see Rob Iliffe, "Those 'Whose Business it is to Cavill': Newton's Anti-Catholicism," in *Newton and Religion*, ed. Force and Popkin, pp. 97–119, esp. 109–12.

> been y^e^ most unchast & superstitious part of mankind as well in this first age as in all following ages. For it was a general ~~maxim~~ ⟨notion⟩ amongst them that after any man became a Monk he found himself more tempted by the Devil to lust then before & those who went furthest into y^e^ wilderness & profest Monkery most stricktly were most tempted, ⟨the Devil (as they imagined) tempting them ⟨most when it was⟩ to divert them from the best purpose⟩.[47]

Newton thus finds it necessary to make a qualification when describing the beliefs of others on the devil: experiences of Satanic influence were merely products of the fallible and self-deceptive human imagination.

Newton goes on to note immediately afterward the irony, "that to turn a Monk was to run into such temptation as Christ has taught us to pray that God would not lead us into. For lust by ~~a violent prohibition~~ ⟨being forcibly ~~resisted restrained~~ restrained⟩ & by struggling w^th^ it is always inflamed." But Newton, whose bookish, celibate, cloistered existence in Cambridge was, after all, not altogether unlike that experienced in the fourth-century monasteries, had also carefully worked through the psychology of temptation:

> The way to be chast is ~~to~~ ⟨not to contend & struggle with unchast thoughts but to decline them [?]⟩ keep the mind imployed about other things: for he that's always thinking of chastity will be always thinking of weomen & ~~to struggle~~ ⟨every contest⟩ w^th^ unchast thoughts ~~is to~~ ⟨will⟩ leave such ~~deep~~ impressions upon the mind as ⟨shall⟩ make those thoughts ⟨apt to⟩ return more frequently.[48]

It is instructive that in these words, which he all but admits are laden with connotations of reflexivity, Newton tackles the problem of lust without any reference to a literal, external tempter. Newton well knew the source of sin from his own contests with the demons of his soul. It was not the devil who made him do it. Unlike the monks of old, Newton's own battles with the devil were with himself.

Newton's strong aversion to "Monkery" may have helped stimulate or reinforce his denial of the devil in a second way. When criticizing Athanasius' *Vita S. Antoni* (*Life of St. Antony*) for its excessive recourse to fanciful miracles and gratuitous accounts of demonic activity, Newton comments that this work "set all the Monks upon an humour of of [sic] pretending to miracles . . . so that y^e^ whole world presently rang w^th^ stories of this kind. And ⟨hence⟩ it came to passe that y^e^ lives of ⟨~~almost~~⟩ all y^e^ first ~~monk~~ & most eminent Monks were filled w^th^ apparitions: of Devils . . . miraculous cures of diseases ⟨prophesies⟩ & other prodigious relations."[49] In a related manuscript, Newton writes further about Athanasius' attempt to secure Trinitarianism by contending that demons had cried out that they were afflicted with torments when they denied the doctrine. In this document, Newton records the testimony of Ambrose, who confirmed that "y^e^ Arians opposed &

[47] Newton, Clark MS, fol. 67Ar.
[48] Ibid.
[49] Ibid., fol. 66r.

derided these miracles," flatly rejecting this putative demonic activity as "not true torments of Devils but feigned & contrived ~~simulations~~ mockeries." What is more, Newton records that Paulinus in his *Life of Ambrose* testifies to the Arian party's claim "that men were hired wth money to counterfeit Demoniacks. & that one of y^{e} multitude being thereupon seized wth a⟨n⟩ ~~Devil~~ unclean spirit cried out: let them be so tortured as I ~~am~~ was, who should deny the martyrs or who should not believe in y^{e} truth of the Trinity w^{ch} Ambrose confesses." Such stories, Newton believed, "sufficiently ~~show~~ ⟨open⟩ the ~~meaning~~ ⟨design⟩ of Athanasius & his party in ~~propagating~~ setting on foot this humor of pretending miracles."[50] Newton, who took the side of the Arians in the fourth-century Trinitarian controversies, would have been predisposed to accept the Arian point-of-view on these demonic apparitions as well. Although the Arians did not reject the existence of demons *per se*, it is possible that in much the same way as Protestant arguments for rejecting Catholic miracles were extended by some radical Protestants to question even some miracles affirmed by Protestants, Newton's acceptance of the Arian scepticism towards the devils conjured up by Trinitarians took root and expanded to embrace a wider scale of doubt in these matters.

Whatever its origins, Newton appears to have held to this position of a non-literal devil for the rest of his long life. In his later writings, the devil became an emblem of sin and opposition to the true God. At the beginning of his "Irenicum," probably composed sometime after 1710, Newton writes that believers "are to forsake the Devil, that is, all fals Gods, & all manner of idolatry." The meaning here is plain. Closely associated with the requirement to abandon idolatry is the need to forsake the "flesh" and the "lust of the flesh."[51] Newton's aetiology of sin is human centred. Several times in the series of drafts that make up the "Irenicum," Newton both reiterates his claim that the devil is idolatry and links this equation with a statement on the lusts of the flesh.[52] In another example from late in the manuscript, Newton conflates the two statements when he writes that ancient Christians "were to forsake the Devil, the lusts of the flesh the lust of the eye & the pride of life"—the three lusts of 1 John 2:16. His repeated attention to these lusts and

[50] Newton, Butterfields Lot 3089, recto. Unlike Newton, when mentioning "the spurious Miracles so current under *Athanansianism* and *Popery*", Whiston had no trouble suggesting that "there have frequently been Dæmoniacal Operations and Illusions intermixed with them: and that from the very days of *Anthony* the Monk, to our own Age" (Whiston, *Reflexions on an anonymous pamphlet, entituled, a Discourse of free thinking* (London, 1713), p. 26). Given Newton's animus towards Athanasianism and Catholicism, it is all but certain that he would have attributed their teachings to demons had he believed such were ontologically real. As Newton records from another historical account in this same manuscript fragment, the Arians went further in their scepticism of these accounts than did Eunomius, the founder of the Anhomoians (neo-Arians), who attributed the deception to the "juggling tricks" of real demons, who "did not truly cry out but counterfeit their torments" (Butterfields Lot 3089, recto).

[51] Newton, Keynes MS 3, p. 1.

[52] Ibid., pp. 9, 23, 25, 31, 39, 43; Newton, Keynes MS 6, fol. 1r ("We are to forsake the Devil & his works that is fals gods & idols").

their ill effects helps demonstrate that for Newton there was not necessarily any significant reduction in the potency of the devil, only an interiorization of this very real power in the heart of man. Newton then continues to delimit the meaning of forsaking the devil in a most revealing way: "To forsake the Devil is to forsake the worship of Demons or Ghosts & of all fals Gods whatsoever collectively called the Devil."[53] The "Devil", then, is a symbol of lust and a vivid hypostatization of idolatry in aggregate. This language cannot be reconciled with the orthodox position.

This language does, however, have some of its roots in orthodoxy. In a section of the 1639 Anglican Book of Common Prayer entitled "The ministration of Baptisme to be used in the Church," the priest is instructed to inform the Godfathers and Godmothers of their responsibility to guarantee that the baptised infant would "forsake the devill and all his works, and constantly beleeve Gods holy word, and obediently keep his commandments." Further to this, the Godparents were to be asked:

> Doest thou forsake the devill and all his works, the vain pomp and glory of the world, with all covetous desires of the same, the carnall desires of the flesh, so that thou wilt not follow, nor be led by them?[54]

Newton owned this edition of the prayerbook,[55] which embodied the rites of the Church of England, its soiled pages mute testimony to his use of the book in Anglican liturgy. That Newton was familiar with the last-quoted words is made plain by his quotation of them *in extenso* and almost verbatim at a point in his "Irenicum" where he lists "[t]he fundamentals requisite to communion in the Church of England."[56] As should now be apparent from other places in this manuscript just quoted, however, Newton also altered and embroidered the language of the prayerbook to suit his heterodox doctrinal position. In one of the fuller examples, he writes:

> We are to forsake the Devil, that is all fals Gods & all manner of idolatry this being a breach of the first & great commandment. And we are to forsake the flesh & the World, or as the Apostle John expresseth it, the lust of the flesh the lust of the eye & the pride of life, that is, unchastity, ⟨intemperance, injustice,⟩ covetuousness, pride, & ambition, these things being a breach of the second of the two great commandments.[57]

There is in Newton's formulation no double signification as in the Anglican statement. Absent from Newton's own text are the words "and all his works." These are replaced with a statement of equivalence ("all fals Gods & all manner of idolatry" being Newton's own gloss) and the resultant diabology

[53] Ibid., p. 43.
[54] *The Book of Common Prayer: and Administration of the Sacraments: and other Rites and Ceremonies in the Church of England* (London, 1639), sig. C5v.
[55] Harrison, *Library of Newton*, item 240.
[56] Newton, Keynes MS 3, p. 51.
[57] Ibid., p. 9.

has only one layer of temptation (the tempted), rather than two (tempter and tempted).

Newton's departure from orthodoxy can therefore also be measured by his desire and need to adapt and modify the familiar language of Anglican ritual to conform to his own sensibilities.

The Devil (Not) in the Details: The Hermeneutics of Accommodation

It would be misleading, however, to frame Newton's conclusions about the devil and demons as rationalizing allegory. Instead, he believed he was stripping off the metaphysical layers of meaning that had been erroneously added by the apostate Church. The origins of these new meanings were to be found in Gentile, that is to say, pagan, theology. It was the apostate Church, not he, that had engaged in corrupt hermeneutics. Nevertheless, Newton does utilize an interpretative strategy to underpin his conclusions about evil spirits. Newton's method is revealed in a passage quoted above in which he explains that when the vivid language of demon-possession is used in the Bible, "Christ seems to have used this language not only as Prophet but also in compliance wth y^{e} Jews way of speaking."[58] This is the hermeneutics of accommodation, in which it is argued that the Bible is written in the language of the vulgar, but that behind this accommodating idiom lies the reality that the philosophic mind can discern. It is the same hermeneutic that Newton, like Galileo before him, used to reconcile apparently geocentric language in the Scriptures with his commitment to a heliocentric, geokinetic solar system. Newton believed that the Scriptures do not speak "in the language of Astronomers . . . but in that of y^{e} common people to whom they were written."[59] And so it was with demon possession.

An early hint at how accommodation could explain the cases of demon-possession mentioned in the Gospel accounts can be found in Joseph Mede's posthumously published *Diatribæ* (1642), which contains a short essay on the demon language of the New Testament. While not denying the literalness of demons himself, Mede opened the door to Newton's view (and possibly the sceptical position as well) when he argued that the designation of someone demon-possessed in the New Testament was equivalent to labelling them as "*mad-men*" or "*Lunaticks*" in the parlance of his own day.[60] Newton himself was convinced that contemporary labels could not always be

[58] Newton, Yahuda MS 9.1, fol. 21v.

[59] Newton, CUL MS Add. 4005, Sec. 7, published in I. Bernard Cohen, "Isaac Newton's *Principia*, the Scriptures, and the Divine Providence," in *Philosophy, Science, and Method*, ed. Sidney Morgenbesser et al. (New York: St. Martin's Press, 1969), p. 544.

[60] Mede, *Diatribæ. Discovrses on Divers Texts of Scripture* (London, 1642), pp. 120–31 (quotations from p. 123).

read straightforwardly, in part because of diachronic shifts in the meaning of names. In one manuscript he writes:

> We are also to allow for the changes that have been made in the signification of words. So Cherubim were originally nothing more than hieroglyphical symbols or armies & other bodies politick. Spirits frequently signified the tempers & dispositions of the mind; & evil spirits the diseases & distempers thereof as when Saul was troubled with an evil spirit from the Lord; Devils signified the imaginary Ghosts of dead men whom the heathens worshipped as Gods; Inchanters, Magicians, Sorcerers, Necromancers & Witches signified deceivers & cheats who by certain forms of words & ceremonies & other juggling tricks pretended to supernatural powers & arts of prognosticating for magnifying themselves among the people.[61]

Thus evil spirits reduce to diseased states of mind, devils to imaginary ghosts and witches to conjurers.

Newton believed that the need to retrieve the true meanings of such designations was demanded not only by the implied corruption in language, but because biblical idiom is often couched in expressions directed to the sensibilities of the vulgar. The superstitious among the vulgar are prone to misread this accommodating language in a literal way and thus mistake evil spirits for real substances, just as the idolaters took the pagan gods to be real substances. Newton thus held that in 1 John 4 the "spirits of God of fals Prophets & of Antichrist are . . . plainly taken not for any substantial Spirits but for y^{e} good or evil dispositions & true or fals perswasions of mens minds."[62] Similarly Moses' descriptions of divination, enchantment, witchcraft, wizardry and necromancy were never meant to be taken in a "metaphysical" sense for actual spiritual operation, but rather in a "moral" sense for the deceptions, delusions and conjurations that masqueraded such activity as real.[63] Finally, Newton also believed that due care must be taken to allow for the penchant of the ancient "eastern & Egyptian nations" to employ the language of personification:

> The eastern & Egyptian nations were very much addicted to speake by figures in their language to introduce the qualities and substances of things under the character of intelligent beings or persons. So things often represented death & the grave & time & fortune & health & wealth & love & flame & the elements & planets by persons; the Jews gave the names of evil spirits to diseases & to vices and amorous opinions & so Solomon spoke of wisdom as a person & Orpheus, Plato & Philo & some of the gnosticks gave the name λογος to the wisdom of God, considered as a person . . . . And the Idea of the Platonists, sephiroths of the Cabbalists, & Aeons of the Gnosticks are nothing else than the thoughts notions

[61] Newton, New College, Oxford MS 361.2, fol. 133r, cited in Manuel, *Isaac Newton, Historian*, p. 149.
[62] Newton, Yahuda MS 9.1, fol. 20v.
[63] Newton, Bodmer MS, 5A, fol. 8v.

> actions previous names attributes or parts of the deity turned into persons & sometimes into the souls of men.[64]

Here Newton's references to Solomon, Plato and Philo imply that he believed that the learned also personified qualities and substances. And, as the above excerpt demonstrates, Newton maintained that the hypostatization of diseases as demons was one example of the language of personification. But to take this personification literally instead of figures of speech was to commit the sin of idolatry.

The Doctrinal ``chain of connexion''

Joseph Glanvill asserted that "he that thinks there is no *Witch*, believes a *Devil gratis* . . . And when men are arrived to this degree of *diffidence* and *infidelity*, we are beholden to them if they believe either *Angel*, or *Spirit*, *Resurrection* of the *Body*, or *Immortality* of *Souls*. These things," Glanvill argued, "hang together in a *Chain* of *connexion*, at least in these mens *Hypothesis*; and 'tis but an happy chance if he that hath lost *one link*, holds another."[65] While Newton by no means repudiated good angels or a bodily resurrection, Glanvill nevertheless hit upon an important insight. Both the orthodox system and Newton's heterodox scheme hang together in a doctrinal "chain of connection."

First, Newton's non-literal demonology impacted on his prophetic exegesis, and we have already seen how his view on the devil affected his later writings on the Apocalypse. Second, Newton's denial of demons and his characterization of them as departed spirits dovetails neatly with his rejection of the immortality of the soul. In his mortalist system, there was no place for ghosts, whether good or evil. The orthodox position, conversely, accepted both demons and immortal souls. Also, Newton's understanding of the "doctrines of demons" helped him conclude that Catholic saintly intermediaries were ontologically, as well as doctrinally, false. The same can be said for his views on idolatry. Newton's mortalism is not the only aspect of his doctrine that relates well to his rejection of evil spirits. His rejection of infant baptism in favour of adult believers' baptism is made possible partly through his denial of demons, since one chief motivation for Christians to baptise infant children was to protect them from demonic influence. Newton's powerful monotheism, sharpened by his antitrinitarian view that centralized the powers of Deity in the Father alone and combined with his profound, over-arching sense of God's absolute dominion and unchallenged sovereignty,[66] probably also played an

[64] Newton, Yahuda MS 8.1, 2r, cited in Kenneth Knoespel, "Interpretive Strategies in Newton's *Theologiae gentilis origines philosphiae*," in *Newton and Religion*, ed. Force and Popkin, p. 190. I have replaced "sephizoths" with "sephiroths" in this transcription.

[65] [Glanvill], *A Blow at Modern Sadducism*, 4.

[66] On which, see James E. Force, "Newton's God of Dominion: The Unity of Newton's Theological, Scientific, and Political Thought," in James E. Force and Richard H. Popkin, *Essays on the Context, Nature, and Influence of Isaac Newton's Theology* (Dordrecht: Kluwer, 1990), pp. 75–102.

important role in Newton's banishment of demons and that chief opponent of the Deity, Satan himself. As in the original Hebraic theistic monism, God kills and makes alive, He wounds and heals, He forms light and creates darkness, He makes peace and creates evil: Newton's God does all these things.[67] In Newton's system, the One true God stood unchallenged by either pagan gods or fallen angels. In sum, while undoubtedly related to his renunciation of unscriptural superstition, Newton's rejection of evil spirits is consistent with both the general thrust of his biblical hermeneutics and the contours of his theological system.

Witch-hunters, Sceptics and the Theological Location of Newton´s Demonology

Newton developed his non-literal demonology against a backdrop of works like those by Glanvill, who openly deplored any attempts to downplay the reality of witches and demons. And Glanvill was by no means the only one to take this stance. Many of Newton's colleagues at the Royal Society, including the highly-esteemed Robert Boyle, saw the collection of case studies of witches and demons as forming an important part of the polemic against unbelief.[68] Proof of the reality of evil spirits helped confirm the existence of God, who is the greatest Spirit. For this reason, the doctrinally conservative viewed with great horror those who where not merely sceptical about the veracity of particular witchcraft cases, but denied demons outright. Thus it was for commentators such as the Calvinist heresy-hunter John Edwards who wrote in 1695 that:

> among the Opinions which lead to Atheism, the denial of *Dæmons* and *Witches*, which of late hath so much prevail'd, is none of the least. For besides that this is an open defiance to unquestionable History, Experience and matter of Fact, and so introduces the worst sort of Scepticism (which is the high-way to Atheism) it is evident that this supplants the belief of *Spiritual Beings* or *Substances:* for Witchcraft and all Diabolick Transactions are disbeliev'd on the account of the improbability, if not impossibility of *Spirits*. So that it is plain the rejecting of the being and commerce of Dæmons or Infernal Spirits opens a door to the denial of the Deity, of which we can no otherwise conceive than that it is an *Eternal Spirit*.[69]

[67] Deuteronomy 32:39; Isaiah 45:7.

[68] On this, see Charles Webster, *From Paracelsus to Newton: Magic and the Making of Modern Science* (Cambridge: Cambridge University Press, 1982), pp. 75–103.

[69] John Edwards, *Some Thoughts Concerning the Several Causes and Occasions of Atheism, especially in the Present Age* (London, 1695), pp. 100–1. Already in 1669, John Wagstaffe, who expressed doubt in the reality of witchcraft, complained that "[t]he zealous affirmers of Witchcraft, think it no slander, to charge those who deny it with Atheism. As if forsooth the denyal of Spirits and of God did necessarily follow the denial of *Witches*: An errour so gross, that it doth not deserve a confutation." See, Wagstaffe, *The Question of Witchcraft Debated; or a Discourse against their Opinion that Affirm Witches* (London, 1669), sigs. A3r–v.

Others, such as the Lutheran theologian August Pfeiffer, were convinced that loss of belief in the devil would lead to moral degeneration in society. As Jonathan Israel summarizes, Pfeiffer maintained in a 1694 work that "if temptation is natural, and not satanically induced, then in principle extramarital fornication, whoring, and every form of promiscuity is permissible, as are lewd thoughts and words."[70] The antiquary Ralph Thoresby FRS records an evening in 1712 in which he sparred verbally until late with a group of London "freethinkers," who, he wrote, denied "the existence of spirits, downright affirming those [expressions] in Scripture, the works of the flesh, and the works of the Devil are [synonymous], there being no such thing as a Devil in their opinion." Thoresby writes of being "troubled" at their views, and concludes his account with the prayer: "The Lord enlighten their dark minds, and let not much learning make them mad!"[71] Although Newton fully accepted the existence of good angels, it is clear from these examples that many of Newton's more orthodox contemporaries would have viewed Newton's position on the devil and demons as a dangerous example of scepticism verging on materialism and atheism with potentially immoral consequences.[72] Such a characterization of his demonology, however, would have been gravely mistaken. Newton was a thorough-going biblicist who was himself violently opposed to the perceived rise in unbelief. Newton had no truck with scepticism or infidelity and always expressed his position in scriptural language.

How, then, are we to position Newton's demonology? The right place to look for analogies to Newton's view is not among the works of radical sceptics, but within biblicist religious traditions that lay beyond the pale of mainstream Catholic and Protestant doctrinal standards. The first relevant analogy is the pre-modern theology of rabbinic Judaism. The notion of Satan as an evil, fallen angel—a commonplace of orthodox Christian theology—is absent from the Talmud and Midrash.[73] The Adversary (*hassatan*) is not an angel

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On Wagstaffe's work, in which he depowered but did not deny the devil, see Michael Hunter, "The Witchcraft Controversy and the Nature of Free-thought in Restoration England: John Wagstaffe's *The Question of Witchcraft Debated* (1669)," in Michael Hunter, *Science and the Shape of Orthodoxy: Intellectual Change in Late Seventeenth-century Britain* (Woodbridge, Suffolk: Boydell, 1995), pp. 286–307.

[70] Jonathan Israel, *Radical Enlightenment: Philosophy and the Making of Modernity 1650–1750* (Oxford: Oxford University Press, 2001), p. 395.

[71] Entry for 21 August 1712, *The Diary of Ralph Thoresby*, ed. J. Hunter (London, 1830), 2:159. For the reaction of a contemporary American puritan to Sadducism, see Reiner Smolinski, "Salem Witchcraft and the Hermeneutical Crisis of the Seventeenth Century: Cotton Mather's Response to Thomas Hobbes and the 'Modern Sadducees'," in *Die Salemer Hexenverfolgungen: Perspektiven, Kontexte, Repräsentationem/ The Salem Witchcraft Persecutions: Perspectives, Contexts, Representations* (Trier: Wissenschaftlicher Verlag Trier, 1994), pp. 143–83.

[72] *Cf.* Thomas, *Religion and the Decline of Magic*, p. 573; Andrew Fix, "Angels, Devils, and Evil Spirits in Seventeenth-Century Thought: Balthasar Bekker and the Collegiants," *Journal of the History of Ideas* 50 (1989), pp. 536–7.

[73] A. Cohen, *Everyman's Talmud* (London: J. M. Dent, 1949), p. 55.

who fell from heaven but is seen according to an influential school of thought as a hypostasization or personification of *yetzer ha-ra*, the "evil inclination" within the heart of man.[74] According to one strand of rabbinic theology,[75] there were before the purging of idolatry from Israel two evil *yetzerim*, one acting as an impulse to idolatry and the other to unchastity—the same two main focuses in Newton's writing on outworkings of the devil's influence. Newton's later expressions about the nature of Satan are for practical purposes indistinguishable from the Jewish "evil yetzer."[76]

A second parallel comes from the Radical Reformation of the sixteenth and seventeenth centuries.[77] Newton's views on the devil and demons bear a marked resemblance to positions arrived at by Radical Reforming theologians dating back to the early years of the Reformation. One particularly notable analogy is the antitrinitarian Anabaptist Hans Denck (1495–1527), who appears to have come to deny the literal existence of a personal devil. His biographer affirms that for Denck "there was nothing real in the world but God, and therefore anything opposed to God was essentially nothingness."[78] Denck's powerful emphasis on an absolute monotheism, which inclined to the exclusion of the reality of opposing forces, may have helped shape his thought on the devil. It is possible to be much more certain about the Radical Reformer David Joris (*c*. 1501–1556), who came to view Satan as a symbol for human desires.[79] A strong tendency to downplay the role of the demonic in human

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[74] On the doctrine of the *yetzer ha-ra*, see Jeffrey Burton Russell, *Satan: The Early Christian Tradition* (Ithaca: Cornell University Press, 1981), pp. 28–9, 32, 41–3, 49, 137–8, and 182; idem, *The Devil: Perceptions of Evil from Antiquity to Primitive Christianity* (Ithaca: Cornell University Press, 1977), pp. 176, 213, and 236; Roy A. Stewart, *Rabbinic Theology: An Introductory Study* (Edinburgh: Oliver and Boyd, 1961), pp. 81–5, and 88; Cohen, *Everyman's Talmud*, pp. 54–5, 88–93. It is significant that both the vocabulary and underlying conceptualization of the Jewish *yetzer ha-ra* derive from the Bible, in particular, Genesis 6:5, which thus summarizes the wickedness of antediluvian humanity: "And God saw that the wickedness of man was great in the earth, and that every imagination [*yetzer*] of the thoughts of his heart was only evil [*ra*] continually" (see also Genesis 8:21.) For a full study of Newton's engagement with Jewish theology, see Matt Goldish, *Judaism in the Theology of Sir Isaac Newton* (Dordrecht: Kluwer, 1998).

[75] Stewart, *Rabbinic Theology*, p. 81.

[76] The superficial resemblance of Newton's view to modern, liberal interpretations of the devil as a psychic (rather than personal) force notwithstanding, we must resist the Whiggish temptation to cast this position as somehow proto-modernist in tone. The analogy of the Jewish *yetzer ha-ra*, a product of *ancient* thought, is a helpful corrective to this sort of mistaken conclusion. Newton's biblicism also distances him from modern, liberal exegesis, as does the fact that modernist interpretations are inspired by a constellation of presuppositionary ideologies (such as twentieth-century psychology) to which Newton was not privy.

[77] I elsewhere illustrate other points of contact between Newton's theology and that of the Polish Brethren (particularly in the areas of baptism, mortalism, and antitrinitarianism) in Snobelen, "Isaac Newton, Heretic: The Strategies of a Nicodemite," *British Journal for the History of Science* 32 (1999), pp. 384–7; and Snobelen, "'God of Gods, and Lord of Lords': The Theology of Isaac Newton's General Scholium to the *Principia*," *Osiris* 16 (2001), pp. 191–6.

[78] Alfred Coutts, *Hans Denck 1495–1527: Humanist & Heretic* (Edinburgh: MacNiven & Wallace, 1927), p. 165.

[79] There is a growing literature on this theological trend. See Israel, *Radical Enlightenment*, pp. 375–405; Auke Jelsma, *Frontiers of the Reformation: Dissidence and Orthodoxy in Sixteenth-Century Europe*

illness can also be found in the works of certain Spiritualist and Anabaptist writers.[80] English parallels exist also among the radical religious sects of the Commonwealth.[81] The Ranter Jacob Bauthumley contended in 1650 that the real devil was within human nature, not without. "Men fear a Devill without them," Bauthumley writes, "and so fancy him to be terrible in their apprehensions, never considering that he is in them."[82] Similarly, in 1669 Lodowick Muggleton argued—against both orthodox and popular tradition—that the familiar spirit the Old Testament Witch of Endor conjured up was nothing other to the witches than "the imagination or reason, the devil in themselves; that is, they set themselves apart with the thoughts of the imaginations of their hearts."[83] Strong parallels to Newton's demonology and diabology also appear in Thomas Hobbes' *Leviathan* of 1651, even if the latter's overall agenda differed than that of the former.[84] Hobbes appeals to the hermeneutics of accommodation and concludes: "I see nothing at all in the Scripture, that requireth a beliefe, that Daemoniacks were any other thing but Mad-men."[85] For Hobbes demons "are but Idols, or Phantasms of the braine, without any reall nature of their own, distinct from humane fancy; such as are dead mens Ghosts, and Fairies, and other matter of old Wives tales."[86] Biblical references to Satan are treated in a similar fashion. Thus, the description in Luke 22:3 of Satan entering into Judas refers to "the hostile and traiterous intention of selling his Lord and Master."[87] Returning to the Continent, the works of two contemporary Dutch theologians offer further parallels. In his 1683 *De oraculis ethnicorum dissertationes duae*, the Dutch Mennonite Anthonie van Dale radically restricted the power and influence of the devil in worldly affairs to the temptation of the human heart.[88] Finally, another parallel can be seen in the Dutch Calvinist Balthasar Bekker's *Betoverde Weereld* (*The World*

(Aldershot: Ashgate, 1998), pp. 25–39; Gary K. Waite, "From David Joris to Balthasar Bekker?: The Radical Reformation and Scepticism Towards the Devil in the Early Modern Netherlands (1540–1700)," *Fides et Historia* 28 (1996), pp. 5–26; idem, "'Man is a Devil to Himself': David Joris and the Rise of a Sceptical Tradition Towards the Devil in the Early Modern Netherlands, 1540–1600," *Nederlands Archief voor Kerkgeschiedenis / Dutch Review of Church History* 75 (1995), pp. 1–30.

[80] Gary K. Waite, "Demonic Affliction or Divine Chastisement? Conceptions of Illness and Healing Among Spiritualists and Mennonites in Holland, c.1530–c.1630," in *Illness and Healing Alternatives in Western Europe*, ed. Marijke Gijswijt-Hofstra, Hilary Marland, and Hans de Waardt (London: Routledge, 1997), pp. 59–79.

[81] For this, see Thomas, *Religion and the Decline of Magic*, p. 571.

[82] Bauthumley, *The Light and Dark Sides of God* (London, 1650), p. 30.

[83] Muggleton, *A True Interpretation of the Witch of Endor* (London, 1669), p. 3.

[84] Hobbes, *Leviathan*, ed. Richard Tuck (Cambridge: Cambridge University Press, 1991), pp. 56–8, 269–79, 288, 417–18, 440–57.

[85] Ibid., p. 58.

[86] Ibid., p. 418.

[87] Hobbes, *Leviathan*, p. 443.

[88] On Van Dale, see Israel, *Radical Enlightenment*, pp. 361–73. Newton does not appear to have owned this work, although he did posses a copy of van Dale's Dissertationes de origine ac progressu idolatriæ et superstitionum (Amsterdam, 1696). See Harrison, *Library of Newton*, item 483.

Bewitched), published first in Dutch in 1691–94 and then in French (1694) and in partial English translation (1695).[89] Bekker contended that belief in a personal devil and ontologically literal demons was a pagan infiltration into Christianity. He devotes much space in his book to developing scriptural arguments subverting the popular interpretation of biblical texts mentioning the devil and, employing both Scripture and reason, attempts "to prove the Empire of the Devil is but a Chimera, and that he has neither such a Power, nor such an Administration as is ordinarily ascribed to him."[90] Although there is in Newton's writings nothing remotely like Bekker's use of Cartesianism to underpin some of his extra-biblical arguments—and Newton was by this time virulently anti-Cartesian—he would have agreed with Bekker's argument that the devil had no physical reality and was instead a symbol for evil within the human heart. It is also hardly possible that Newton would not have been aware of the enormous controversy that erupted in Europe at the publication of Bekker's book.[91] It may even be significant that Newton's own move away from the orthodox teaching on Satan occurred around the time of the publication of the works of Van Dale and Bekker.

Another hint at Newton's position comes near the end of the third chapter of his church history. At a point where he itemises a revealing series of *adiaphora* ("strong meats" in his biblically-derived terminology), he writes that "besides the first principles & fundamentals of religion . . . w^{ch} all men are to learn before baptism . . . there are ⟨in the scriptures⟩ many truths of great importance but more difficult to be understood & not ⟨so⟩ absolutely necessary to salvation."[92] Included among this list of strong meats are "what Christ did before his incarnation & between his death & resurrection, what he doth now in heaven & ⟨how the saints shall reign with him as . . . Kings & Priests in the day of judgment & rule the nations with a rod of iron &⟩ what he or they shall do after the day of judgment," along with:

> all disputable questions about Providence, Predestination, free Will, Grace, the origin of evil, the ⟨nature of the⟩ satisfaction made by Christ, the nature of angels, the state of the dead between death & the resurrection, the bodies wth

[89] On Bekker, see Andrew Fix, "Balthasar Bekker and the Crisis of Cartesianism," *History of European Ideas* 17 (1993), pp. 577–88; idem, "Angels, Devils, and Evil Spirits," pp. 527–47; Robin Attfield, "Balthasar Bekker and the Decline of the Witch-craze: The Old Demonology and the New Philosophy," *Annals of Science* 42 (1985), pp. 383–95. Newton does not appear to have owned any of the editions of Bekker's work, but his theological interlocutor John Locke owned the French translation of *Betoverde Weereld*. See John Harrison and Peter Laslett, eds., *The Library of John Locke*, 2nd ed. (Oxford: Clarendon, 1971), item 254.

[90] Bekker, *The World Bewitch'd; or, an Examination of the Common Opinions Concerning Spirits: their Nature, Power, Administration, and Operations* ([London], 1695), sigs. c11v–c12r.

[91] On which, see Israel, *Radical Enlightenment*, pp. 382–405.

[92] Newton, Bodmer MS, 3, fol. 22r.

> which the dead shall arise, the power of keys, forms of Church government, the keeping of Easter & other holy days . . . & the like.[93]

That Newton should include the origin of evil in a list consisting of doctrines about which he either had not come to a settled opinion or had dissenting views, hints at a degree of reflexivity in his selection criteria and in turn suggests an awareness on his part of the radical departure he had made in his demonology.

But the nature of Newton's radicalism needs careful clarification. His was a retreat from orthodoxy, not belief. When Newton sought to define the devil he appealed to the scriptural language of idolatry and lust, not to arguments of philosophical or rationalistic provenance. And, unlike Spinoza and the author of *Leviathan*, Newton did not reject the existence of spirits—only the evil kind. Thus Newton was neither a materialist nor a denier of good angels and, hence, not a Sadducee in the biblical sense. His position instead occupied territory within the middle ground between the witch-hunters who saw demons around every corner, and the outright sceptics who flatly denied the existence of any spirits whatsoever. For Newton, this middle ground represented the unadulterated biblical truth.

Isaac Newton and the Devil

As the years wore on the views of men like Joseph Glanvill and Robert Boyle on witchcraft and physical manifestations of demons and ghosts became less and less acceptable in learned circles. This does not mean that Newton's rejection of evil spirits would have been viewed benignly by educated observers. Far from it. For while the growth in scepticism towards witchcraft and demonic activity helped lead to the repeal of the Jacobean Witchcraft Act in 1736,[94] even most of the intelligentsia continued to believe in the reality of demons and their chief diabolical overlord.[95] Denial of the devil was viewed with horror by most well into the nineteenth-century.

Some may instinctively desire to use Newton's non-literal demonology as an indication of incipient rationalism in his thought. This would be a mistake. It would be the same sort of mistake some scholars make when they misidentify Newton's denial of the Trinity as evidence of proto-deist tendencies. And the Bible-reading, prophecy-believing Newton was no deist.[96] Richard Westfall,

[93] Ibid.

[94] On which, see Ian Bostridge, *Witchcraft and its Transformations c.1650–c.1750* (Oxford: Clarendon, 1997), pp. 180–202, and idem, "Witchcraft Repealed," in *Witchcraft in Early Modern Europe: Studies in Culture and Belief*, ed. Jonathan Barry, Marianne Hester, and Gareth Roberts (Cambridge: Cambridge University Press, 1996), pp. 309–34.

[95] *Cf.* Thomas, *Religion and the Decline of Magic*, pp. 475, 573.

[96] James E. Force exorcized this historiographical demon in a brilliant and incisive reply to Richard Westfall's ill-founded attempt to situate Newton on the slippery slope towards deism. See James E. Force,

who knew Newton's theological manuscripts well, nevertheless saw Newton's religion—particularly his heterodox Arianism—as evidence of "the influence of science on his religion", presumably deploying the term "science" here in a way that implies a rationalist tinge. "The central thrust of Newton's lifelong religious quest," Westfall contended, "was the effort to save Christianity by purging it of irrationalities."[97] This is an unhappy choice of words. The picture Westfall paints is one of a man helplessly engulfed by a rising tide of reason and proto-positivistic science. Even Frank Manuel, the scholar who first brought Newton's position on the devil to light, concluded that it was a sign that "[s]cience was taking its toll" on the author of the *Principia Mathematica*.[98] Quite apart from the fact that Newton's demonology should be located firmly within the sphere of biblicist theology, it is hard to see what Manuel's vague assessment could mean. His use of the term "science" here would now be viewed as anachronistic and in any case Newton, unlike Bekker, did not subscribe to any rationalist form of natural philosophy. Indeed, Newton's own natural philosophy was heavily infused with providentialist convictions,[99] and for him theology and natural philosophy were aspects of the same grand project. Newton's beliefs must be interpreted through the legacies to which he was heir, not through the lens of what natural philosophy became.

This is not to say that Newton's mature position on the devil and demons did not interpenetrate with his study of Nature. In this regard, it is worth recalling that the hermeneutics of accommodation was used by Newton to explain apparent geocentric language in the Bible as well as his position on the devil and demons. Not only is there symmetry between his denial of substantial interpretations of evil spirits and his rejection of the introduction of substance into discussions of God's nature, but this suspicion of substance is also evident in the physics of his *Principia*. Likewise, Newton's rejection of falsely-interpreted "metaphysical" readings of spirits in favour of the true "moral" meanings fits into a general pattern evident in both Newton's theology and his natural philosophy. Newton once wrote that "[t]he grand occasion of errors in the faith has been the turning of the scriptures from a moral ~~to a~~ ⟨& monarchical to a physical &⟩ metaphysical ⟨~~& physical~~⟩ sense & this has been done chiefly by men bred up in the ⟨metaphysical⟩ theology of

"Newton and Deism," *Science and Religion / Wissenschaft und Religion*, ed. Änne Bäumer and Manfred Büttner (Büchum: Brockmeyer, 1989), pp. 120–32.

[97] Richard S. Westfall, "Newton and Christianity," *Facets of Faith and Science, Volume 3: The Role of Beliefs in the Natural Sciences*, ed. Jitse M. van der Meer (Ancaster, Ontario: The Pascal Centre/ Lanham, MD: The Univ. Press of America, 1996), p. 73.

[98] Manuel, *Religion of Newton*, p. 64.

[99] A pioneering study in this regard is Simon Schaffer, "Comets & Idols: Newton's Cosmology and Political Theology," *Action and Reaction: Proceedings of a Symposium to Commemorate the Tercentenary of Newton's Principia*, ed. Paul Theerman and Adele F. Seeff (Newark: University of Delaware Press, 1993), pp. 206–31.

the heathens Philosophers . . . ⟨the Cabbalists & ⟨y^e⟩ Schoolmen⟩."[100] This in turn conforms to a broad trend in his thought that led him to distinguish between exoteric (open) and esoteric (closed) levels of knowledge, seen in his distinction between absolute and relative space and time, along with open and closed meanings in theology. A reading of the New Testament that yields demonds, then, would fall into the esoteric category, while a reading that interprets as distempers would fall into the closed category y.[101] Newton's demonology would have had direct repercussions for his natural philosophy as well. The banishment of evil spirits would have allowed him to avoid the natural philosophical anxieties caused by Descartes' demon, who for Newton did not exist to deceive human perception in fields such as optics. Finally, in contrast to his disciple, William Whiston, there could be for Newton no recourse to evil spirits to explain spectacular meteorological phenomena like the *aurora borealis*. Suggestively, Whiston even publicly lamented Newton's reticence to appeal to demons for this purpose.[102]

There are some remaining puzzles. It is a curious fact that two men in Newton's circle published works after the great man's death in which they openly argued for a view on biblical demons that differed not at all from that of Newton. First, Arthur Ashley Sykes, a clerical friend of Samuel Clarke's whom Newton helped appoint to an afternoon preachership at Golden Square in London, published a controversial work on the meaning of demoniacs in the New Testament in 1737, the year after the repeal of the Witchcraft Act.[103] In this treatise Sykes, who was given some of Newton's theological papers in the 1750s to prepare for publication,[104] presents a sophisticated and learned

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[100] Newton, Yahuda MS 15.5, fol. 97r. For more on this, see Snobelen, "'God of Gods, and Lord of Lords'."

[101] For more on Newton's epistemological dualism, see Snobelen, "'God of gods, and Lord of lords,'" pp. 205–6.

[102] Whiston, *Memoirs of the Life and Writings of Mr. William Whiston*, 2 vols (London, 1753), 2:195–7. On this, see Webster, *From Paracelsus to Newton*, pp. 98–9. Whiston also had little difficulty in attributing charismatic revelation to demonic influence. When Whiston met with the French Prophets in or about 1713, he gave them his reasons "why, upon supposition of their agitations and impulses being *supernatural*, [he] thought they were *evil* and not *good* spirits that were the authors of those agitations and impulses," and affirmed that "Wild agitations are rather signs of dæmonical possessions, than of a prophetic afflatus." See Whiston, *Memoirs*, 1:119–20.

[103] Sykes, *An Enquiry into the Meaning of Demoniacks in the New Testament* (London, 1737). See also, idem, *A Further Enquiry into the Meaning of Demoniacks in the New Testament* (London, 1737).

[104] After the 23 May 1737 death of her husband John Conduitt, in whose possession the Newton manuscripts lay, Newton's half-niece Catherine Condiutt (née Barton) added a codicil to her will on 26 June 1737 in which she stipulated that her executor was to entrust Sykes with Newton's theological tracts with the intent that the former should prepare them for publication (New College, Oxford MS 361.4, fol. 139r.) In fact, the manuscripts (and even then only a fraction of them) do not appear to have been transferred to Sykes' care until 1755. Sykes died shortly afterward and therefore was not able to accomplish the task (British Library Add. MS 4319, fol. 91.) Although firm evidence of Sykes' access to Newton's manuscripts only exists for a date long after 1737, the naming of Sykes in Catherine Conduitt's will in the very year of the publication of his works on demons is striking. It is possible that sometime before John Conduitt's death, Sykes was given preliminary access to Newton's papers—a scenario that would

argument to show that the New Testament demons were not ontologically real spiritual entities, but were rather distempers of the mind and are depicted in the Gospels as devils using accommodationist language. Also, as with Newton, demons are equated with ghosts. Furthermore, employing his knowledge of Hebrew, Sykes defines the word Satan as "nothing else but *Adversary*," and contends that it should be "understood according to the subject to which it is applied."[105] Thus, when in the Gospel accounts a woman is characterized as being "*bound of Satan*," this, "when applied to an *Infirmity*, means no more than that which was an Adversary to Health."[106] To support his contention, Sykes goes on to list scriptural examples of human adversaries designated as satans.[107] As for those who arrogate to themselves the power of casting out demons (such as the seven sons of Sceva in Acts 19:13–17), they are nothing more than cheats.[108] In both the general tenor of his position, and the specifics of his arguments, Sykes' demonology displays a haunting similarity to that of Newton.[109]

Second, Richard Mead, one of the doctors who cared for Newton in his final illness and one of the last to see him alive, published in a work on biblical diseases a briefer version of the argument that demon-possession is but another name for madness.[110] Mead, a Fellow of the Royal Society who had in Newton's lifetime published a study of lunacy, cites both the 1642 essay of his namesake and Sykes' full-length study of 1737, so it is possible that his main incentive came from others. Nevertheless, the association with Newton is striking. Did Newton's ideas play a formative role in the thought of either of these two men? The lack of direct evidence allows no confirmation of this possibility, although Newton did reveal aspects of his heresy to others.[111] What is certain is that these men articulated positions on demons that were indistinguishable from those of Newton. Finally, it may be worth noting that the MP who in 1736 first presented to the House of Commons and then delivered to the House of Lords the bill to repeal the Jacobean Witchcraft Act was none other than John Conduitt, Newton's nephew-in-law,

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help explain why Catherine named him for the work of editing them after her death (which occurred in 1740.)

[105] Sykes, *Enquiry into Demoniacks*, p. 54.

[106] Ibid., p. 55.

[107] Ibid., pp. 55–6.

[108] Ibid., p. 60.

[109] Among the responses to Sykes' work advocating the orthodox literal demonology, was William Whiston's tract *An Account of the Dæmoniacks, and of the Power of Casting out Dæmons, both in the New Testament, and in the Four First Centuries* (London, 1737.)

[110] Mead, *Medica sacra; or, a Commentary on the Most Remarkable Diseases, Mentioned in the Holy Scriptures* (London, 1755; orig. publ. in Latin in 1749.)

[111] On this, see Snobelen, "Isaac Newton, Heretic," pp. 401–8.

successor at the Royal Mint, and custodian of Newton's unpublished papers.[112]

In this study, I have shown that there was more than one way for an early modern believer to orient biblical demonology. In Newton's case, it meant the denial of the existence of evil spirits. A corollary to this was a shift from an ontology of Satan to a psychology of temptation, a reorientation from the external to the internal. But instead of looking for possible affinities with his view in sceptical thought or suggesting a source in some putatively rational or 'modernist' strain of natural philosophy, I have argued that Newton's demonology formed an integral part of his grand religious project and that the most relevant analogies lie in theology—ancient and heterodox. It is likely that it owed much to the massive religiously-motivated study of pagan idolatry in which Newton became immersed during the late 1680s and early 1690s—a study revealed in his surviving manuscripts on the origin of Gentile theology. His view may also have been partly motivated by empathy for the fourth-century Arian party, who rejected Athanasius's testimony of demon-plagued monks as a Machiavellian attempt to legitimate the Trinitarian cause when terms from reason failed. Newton articulated his own position in biblical terminology and above all, as with so many other aspects of his theological and natural philosophical thought, his views on the devil were reinforced by an engagement with older traditions. The apparent 'modernity' of his stance turns out to be a mirage. Newton's demonology was an *exegetical* option, not a sign of the encroaching Enlightenment. Nevertheless, we must not lose sight of the fact that Newton's denial of evil spirits was well outside the theological mainstream in his own day and for a long time afterward. His position would have been viewed as a runway to infidelity, a capitulation to cold, dark atheism, a disturbing disenchantment of the world or even a delusion inspired by Beelzebub himself. If only his witching-hunting colleagues at the Royal Society had known.

[112] Bostridge, *Witchcraft and its Transformations*, pp. 182–3; idem, "Witchcraft Repealed," in Barry, Hester, and Roberts, Editors, *Witchcraft in Early Modern Europe*, p. 319.

ESSAY 9

Women, Science, and Newtonianism: Emilie du Châtelet versus Francesco Algarotti

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> I rejoice that I have lived to see female education conducted on a more liberal and enlarged plan. I am old enough to remember a time when well-born women, even of the north, could spell their own language but very indifferently, and some, hardly read it with common decency; when the young lady's hand-writing presented a medley of outlandish characters; and when a column of pounds, shillings and pence presented a labyrinth, as inextricable as the extraction of the cube root. While the boys of the family were conversing with Virgil, perhaps with Homer himself, the girls were condemned to cross-stitch, on a piece of gauze canvas, and to record their own age at the bottom of the same.

So wrote Henry Hunter in the preface to his translation of Leonard Euler's *Briefe*, his *Letters of Euler to a German Princess on Different Subjects in Physic and Philosophy* (1795).[1] Hunter continues his reflection on the improved state of women's education—

> They [women] are now treated as rational beings, and society is already the better for it. And wherefore should the term *female* and *philosophy* seem a ridiculous combination? Wherefore preclude to a woman any source of knowledge to which her capacity, and condition in life entitle her to apply? It is cruel and ungenerous to expose the frivolity of the sex, after reducing it to the necessity of being silly and frivolous.[2]

[1] Leonard Euler, *Briefe an eiener deutsche Prinzessin über verschiedene Gegenstande aus der Physik und Philosophie* (Leipzig, 1769), [English trans. H[enry] H[unter], *Letters of Euler to a German Princess on Different Subjects in Physic and Philosophy*, London, 1795].
[2] *Letters of Euler*, translator's preface, pp. xi–xii.

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 183–203.
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The translation which this prefaces is of a work first published some thirty years earlier, and originally written for the instruction of a niece of Frederick II of Prussia. Euler's book was specifically aimed at a female audience—to quote his translator, his letters were intended "for the instruction of a young and sensible female". Translated into French as well as English, Euler's book saw several reprintings in both languages, testimony not just to wider educational horizons for eighteenth-century women, but to a demand for scientific knowledge. Furthermore, the science epitomised by Euler in his *Briefe* is deeply Newtonian, and the image of Newton conveyed is of a great genius who cracked the secrets of the natural world. Newton, he says

> was, without doubt . . . one of the greatest geniuses that ever existed. His profound knowledge and his acute penetration into the most hidden mysteries of nature will be a just object admiration to the present, and to every future age.[3]

The publishing success of Euler's *Briefe*, then, is evidence not only of the diffusion of Newtonianism in the eighteenth century, but of a female audience for Newtonian science. The history of the participation of women in Enlightenment science overlaps with the history of Newton's reception in Europe.

The point has long since been made that the eighteenth century witnessed an increase in scientific literacy among women. Londa Schiebinger's claim that, "Science for ladies remained popular throughout Europe in the eighteenth-century," has been followed up by Betty Jo Dobbs and Margaret Jacob, and others, who have demonstrated that his female interest in science had its Newtonian aspect, even if historians of science have not always acknowledged this.[4] The fact that women do indeed figure in the reception of Newtonianism raises questions about levels female attainment in matters scientific, aside from quantative increase of interest. And this, in turn, is bound up with the

[3] *Letters of Euler*, 82. This eulogy is tempered with the observation that Newton was, nonetheless a human being, and therefore subject to error. "But the errors of this great man should serve to admonish us of the weakness of the human understanding which, after having soared to the greatest possible heights, is in danger of plunging into manifest contradiction". The "error" identified by Euler was Newton's emanationist theory of light.

[4] Londa Schiebinger, *The Mind has no Sex? Women in the Origins of Modern Science* (Cambridge, Mass.: Harvard University Press, 1989), p. 39; Betty Jo Dobbs and Margaret C. Jacob, *Newton and the Culture of Newtonianism* (Atlantic Highlands, NJ: Humanities Press, 1995.) On the diffusion of Newtonianism in England, see Larry Stewart, *Rhetoric, Technology and Natural Philosophy in Newtonian Britain, 1660–1750* (Cambridge: Cambridge University Press, 1992); for Newton in France, see P. Brunet, *L'Introduction des théories de Newton en France au XVIII Siècle* (Paris, 1931); A. R. Hall, "Newton in France, a New View," *History of Science*, 13 (1975), pp. 233–50. For the Newton reception in Europe, see H. Guerlac, "Newton's Changing Reputation in the Eighteenth Century," and "Where the Statue stood: Divergent Loyalties to Newton in the Eighteenth Century," in his *Essays and Papers in the History of Modern Science* (Baltimore and London: Johns Hopkins University Press, 1977), pp. 69–81 and 131–45; idem, *Newton on the Continent* (Cornell: Cornell University Press, 1981); A. R. Hall and D. G. King-Hele, *Newton's Principia and its Legacy* (London: The Royal Society, 1988); Paulo Cassini, *Newton e la Coscienza Europea* (Bologna: Il Mulino, 1983).

question of whether the Newtonian revolution made it easier or more difficult for women to participate in science. In suggesting answers to these questions we can, perhaps, learn something about the formation of the Enlightenment image of Newtonianism. What I propose to do in this paper is to revisit the general topic of women and eighteenth-century science from the perspective of the reception of Newtonianism. But, for the purposes of this paper I am less concerned with what Newtonianism tells us about women's participation in science, and more with what the involvement of women tells us about Newtonianism as practised and disseminated in Enlightenment Europe.

Newtonianism for Ladies

The best evidence for female interest in Newtonian science are books like Euler's *Briefe* specifically aimed at a female readership. The most famous example of a Newtonian text aimed at a female audience is *Newtonianismo per le dame ovvero dialoghi sopra la luce e i colori*. (1737) by the urbane Italian free-thinker, Count Francesco Algarotti. Among epitomes and surveys of Newtonianism, the popularity Algarotti's book is normally taken as a positive sign of the growing participation of women in science in the eighteenth century. This book consists of a collection of six dialogues in which an Italian Marchesa, a former admirer of Descartes and Malebranche, is introduced to the basics of Newtonian optics: the fourth dialogue purports to give "An Exposition of the Newtonian System of Optics". The Sixth Dialogue deals with "the Newtonian universal Principle of Attraction". The book was an instant success, many times reprinted (some thirty editions) and translated into several European languages, including Swedish and, apparently, Portuguese.[5] The success of the book is clear testimony to there being a popular readership for Newtonian theories, when presented in an accessible way. Alagarotti's book examplifies an important feature of popularising recensions of Newton, namely, that they specifically avoid the technicalities of mathematics and mechanics. In all the many versions of *Newtonianismo per le dame* Algorotti adopts as his hall-mark a non-technical style. He specifically set out to remove all traces of what he calls "austerity" ("austerita") from Newton's science, removing what he considered to be "disagreeable and tedious", in order to present it in an *agreeable* way. By austerity, Algarotti evidently understood everything to do with numeracy. As he explained in the introduction, "lines and mathematical Figures are entirely excluded, as they would have given these Discourses too scientific an Air, and appeared formidable to those, who to be instructed must be pleased."[6] His French translator, Louis Adrien du Perron de

[5] Peter and Ruth Wallis, *Newton and Newtoniana, 1672–1975. A Bibliography* (London: Unwin, 1977).

[6] Algarotti, *Sir Isaac Newton's Philosophy Explain'd for the use of the Ladies in Six Dialogues on Light and Colours*, trans. Elizabeth Carter (London, 1739), Introduction.

Castera, specifically links this non-technical approach to lower expectations of female understanding, by stating that the omission of "calculs embarassans" makes the book more suitable for "la delicatesse des dames."[7] Voltaire makes a similar assumption in a contrastive comparison between Maupertuis as "teacher of men", and "Algarotti [teacher of]the female sex."[8] Although the title of Algarotti's book indicates that the targeted audience was female, the book was also aimed at non-technical male readers and was deemed suitable, as Adrien du Perron de Castera points out, for men "qui ne sont point initiés dans les mystères de la Philosophie Newtonienne."[9] The tag "for the ladies", therefore, may be taken to imply all readers of non-specialist capacity, and that these were not necessarily exclusively female. That Algarotti had a Newtonian agenda gives some credence to the argument that Newtonianism, especially in its popularised version, offered a more accessible form of science than had the systems to which it put paid.

Algarotti was not the only populariser to offer Newton without numbers. So too, for example, did Desaguliers' *A Course of Experimental Philosophy* (1733–4) and Voltaire's *Elémens de la philosophie de Newton* (1738). Voltaire, in particular, emphasised the democratic outreach of his project to the unlearned, "On tâchera de mettre ces *Elemens*, à la portée de ceux qui connaissent de Neuton & de la Philosophie que le nom seul. La Science de la Nature est un bien qui appartient à tous les hommes."[10] His *Elements* is a non-technical exposition of the central doctrines of Newtonian physics which, as one eighteenth-century woman, Lady Mary Wortley Montagu, observed, relies heavily on intermediate sources like Pemberton, Keill, Musschenbroek and Du Fay. S'Gravensande's introduction to Newton, was specifically aimed at younger people.[11] But, in respect of accessibility, it was Newton himself who led the way. And he did so in the text on which Algarotti's book is largely based, *Opticks*. Of Newton's published writings, *Opticks* was easily the most widely known—either directly or indirectly—in the eighteenth century.[12] After all, the *Principia* presupposes a level of attainment in mathematics that was far

[7] Algarotti, *Le Newtonianisme pour les Dames*, 2 vols (Paris, 1738), trans. Duperron de Castera, Préface du traducteur.

[8] Voltaire to Nicolas Claude Thierot, *Voltaire's Correspondence*, ed. T. Besterman, 107 vols (Geneva 1953–65), 7: 157–8.

[9] *Le Newtonianisme pour les Dames*, 2 vols (Paris, 1738), Preface du traducteur.

[10] Voltaire, *Elémens* (Amsterdam, 1738), p. 12.

[11] J. s'Gravensande, *Introductio ad philosophiam Newtonianam* (1720) Whiston's *Sir Isaac Newton's Mathematical Philosophy more Easily Demonstrated* (1716) was also designed "for the use of students." An example of simplified Newtonianism is *The Newtonian System of Philosophy Adapted to the Capacities of Young Gentlemen and Ladies,and familiarised and made entertaining by Objects with which they are intimately acquainted* (London, 1761), which bears an advertisement for the even simpler *Philosophy of Tops and Balls or the Newtonian System of Philosophy Adapted to the Capacities of Youth* by "Tom Telescope." The first was enormously successful and was translated into Dutch, French, Swedish and Italian.

[12] A. R. Hall, *All was Light. An Introduction to Newton's 'Opticks'* (Oxford: Clarendon Press, 1993).

beyond the average reader. As one eighteenth-century woman observed (Lady Mary Wortley Montagu), "I believe there are few heads capable of makeing Sir I. Newton's calculations, but the result of them is not difficult to be understood by a moderate capacity."[13] This is a view to which Madame Du Châtelet subscribed: Newton's philosophy she wrote, bristles with so many calculations and algebra, that it is a kind of mystery, in which only the initiates can participate ("sa Philosophie hérissée de calculs & d'algèbre, étoit une espece de mistere auqel les seuls initiés avoient droit de participer").[14] For his part, when praising Madame Du Châtelet's attainments in mathematics, Voltaire notes in accentuating contrast, that knowledge of mere geometry is not something to be expected among women ("C'eût été beaucoup pour une femme de Sçavoir la Géométrie ordinaire").[15] By contrast with his *Principia mathematica*, Newton's *Opticks* is an accessible and practical, which does not require great technical expertise or complex experimental apparatus. As Newton himself claimed of the experiments therein described, "A Novice may the more easily try them."[16] The largest constituency of novices were, of course, women (though Newton was probably not thinking of them when he referred to novices). Rupert Hall attributes the success of *Opticks* in England to the fact that it was "written in English, founded upon experiments, and (in the Queries) free-ranging in its speculation."[17] The same may be said of its reception in Europe where it was also read in the vernacular (in translation), or assimilated into popularising recensions of Newton's physics. Arguably, therefore, the Newtonianism of popular consumption was "soft" Newtonianism. This is amply illustrated by the most popular of all introductions to Newton's theories, Algarotti's *Il Newtonianismo per le dame*, which, as we have already noted, is the very opposite of the technical.

Another feature of Newtonianism which recommended it to a general audience in the eighteenth-century context, is the fact that it becomes associated with an accessible method of scientific enquiry, a practical experimental method by which epitomes of Newton define themselves as Newtonian and which they claim to use. For example, in his *Introductio ad philosophiam Newtonianam* (1720), s'Gravensande advocates what he understands to be the Newtonian method of investigation, where "conclusions are deduced from

[13] Quoted in I. Grundy, *Lady Mary Wortley Montagu, Comet of the Enlightenment* (Oxford: Oxford University Press, 1999), p. 524. As Paolo Cassini notes, the *Principia* was challenging to non-mathematicians, such as Locke, Halley, and the *eruditi* of Leipzig, and its reputation "was based on the authority of a few competent readers." See "Newton's *Principia* and the Philosophies of the Enlightenment," in Hall and King-Hele, *Newton's Principia*, pp. 35–52, p. 42. See also E. A. Fellman, "The *Principia* and Continental Mathematicians," ibid., pp. 13–34.

[14] [Madame du Châtelet], "Lettre sur les Elemens de la Philosophie de Newton" *Journal des Scavans*, Sept. 1738, pp. 534–41, p. 534.

[15] Voltaire, Preface to Du Châtelet's translation of *Les Principes*.

[16] Newton, *Opticks* (New York, 1952), p. 25.

[17] Hall, *All was Light*, p. 183.

Phaenomena, & Hypotheses rejected."[18] Likewise, in the fourth Dialogue of *Newtonianismo per le dame* Algarotti identifies Newtonianism as experimental philosophy. And Pierre Coste, in his preface to his translation of *Opticks*: stresses Newton's dependence on experience and the fact that his findings are are based on the phaenomena of nature and are verifiable by experiment.[19] This is a theme taken up by other eighteenth-century commentators such as Pemberton in his *A View of Isaac Newton's Philosophy*, (1728). It should of course be said that what is presented as Newtonian is not necessarily purely Newtonian as to content: for example s'Gravensande explains in his *Introductio ad philosophiam Newtonianam* that the "philosophy" he introduces is Newtonian, not because everything in it is Newtonian, but because many important things are (theories of sound, colours, celestial motions, etc.) Euler's *Briefe* may be said to be Newtonian in the same sense. However, such hybrid forms of Newtonianism no doubt served to widen its appeal to the general audience.

There were other reasons for recommend Newton's physics to eighteenth-century readers, besides technical accessibility: the most widely cited was the apologetic value of the Newtonian system. Like many other Protestant promoters of Newton, Pierre Coste assures the reader of his translation of *Opticks* that Newton's philosophy, "leads us necessarily to God, the Author and conserver of things" ("nous conduit nécessairement à Dieu, l'Auteur & le conseruateur de toutes choses.")[20] This was undoubtedly important when recommending Newtonianism to women, whose participation in intellectual activity was so often hedged about with protestations of piety.[21] Nevertheless, while Newtonianism is recommended as theologically sound, Newton is not treated as having his own theological interests in epitomes of Newtonianism. Although the popular image of "this ingenious and candid Scrutator of Things"[22] is certainly that of theist, there is no obvious interest in Newton's theology in these texts, and no take-up, as far as I am aware, of the theological pronouncements in the *Opticks*. Furthermore, purveyors of Newtonianism for ladies also had other reasons for recommending science to women. For example, Henry

[18] J. s'Gravensande, *An Explanation of the Newtonian Philosophy* (London, 1735), sig. A4, English translation of s'Gravensande's *Introductio ad philosophiam Newtonianam* (1720) by Edmund Stone. This work was also translated by Desaguliers (*Mathematical Elements of Natural Philosophy*, 1720) and John Keill (*Mathematical Elements of Physics*). The 1725 Latin edition included an introduction by Keill. Of course, experimentalism was not new with Newton. It was the Dutch, particularly, who developed this aspect of Newtonian method. See T. L. Hankins, *Science and Enlightenment* (Cambridge: Cambridge University Press, 1985), p. 47.

[19] Pierre Coste, *Traité d'Optique sur les Reflexions, Refractions, Influxions, et les couleurs de la Lumière par Monsieur le Chevalier Newton. Traduit par M. Coste.* (Paris 1722 (1st edition 1720), p. xl.

[20] Pierre Coste, *Traité*, sig. eiij.

[21] For example, in his *Memoirs of Several Ladies of Great Britan* (London, 1752), George Ballard comments on the piety and exemplary morals of every one of his subjects.

[22] s'Gravensande, *Explanation*, sig. A3v.

Hunter was moved to translate Euler less out of straightforward admiration of women's minds, than to counter what he saw as the poisonous influence of Rousseau and Voltaire—ironically enough, in view of Voltaire's role in disseminating Newtonianism.[23] In the case of Algarotti, the title "per le dame" may have been a mask used to disguise the fact that his elegant phrases contained unpalatable opinions about the make-up of the universe. It is possible that the device of addressing women, was deliberately adopted so as to evade censorship. His suave and jocular tone belies the fact that the work contained ideas proscribed in post-Galileian Italy—such as that the stasis of the sun. Algarotti seems to have supplied different prefaces to different editions with the same end in view and he extensively revised the work for dedication to the King of Prussia with the title, *Dialoghi sopra l'ottica neutoniana* (1752). Indeed, at least one of the many revised versions was printed with a title that made no reference to women, simply as *Dialoghi sopra la luce, i colori e l'attrazione* (Naples, 1752).

In the eighteenth-century Newton reception, women figure not just as readers of Newton, but as patrons and dedicatees of Newton's writings and other Newtonian works. The most famous example is, Emilie du Châtelet to whom Voltaire dedicated, *Les Elémens de la philosophie de Newton* (1738). In his dedication to her, Voltaire cited her example as testimony to the appeal of science to women.

> La philosophie est de tout état & de tout sexe; elle est compatible avec la culture des Belles-Lettres, & même avec ce que l'imagination a de plus brillant . . . Elle est certainement du ressort des femmes lorsque'elles ont sçu mêler aux amusements de leur sexe, cette application constante, qui peut-être le don de l'esprit plus rare.[24]

Another example of a female patroness, is Princess Caroline of Ansbach, Princess of Wales, to whom Pierre Coste dedicated his French translation of Newton's *Opticks* (Amsterdam, 1720) and whom he credited with having suggested that he undertake the translation in the first place. Although not dedicated to a woman, Algarotti's *Newtonianismo* contained a portrait of his interlocutor, the Marchesa, apparently made to resemble the Marquise du Châtelet.[25] An Englishwoman, Lady Mary Wortley Montagu contributed laudatory verses to the 1739 edition of *Newtonianismo*. It should of course be said that women did not have a monopoly on dedications and translations of Newtonian texts. And Newton was not the only natural philosopher translated or patronised by women.

[23] Euler, *Letters*, p. lxvi.

[24] Voltaire, *Elémens* (2d edition, London, 1745), p. 1.

[25] Emilie Du Châtelet, *Les Lettres de la Marquise du Châtelet*, ed. T. Besterman (Geneva:Institut et Musée Voltaire, 1958). Letters 118, 120, and 135.

Although the textual evidence for a female audience for Newtonianism belongs with the history of the 'popular' reception of Newtonianism, women were not merely passive recipients of Newtonian publications. Not all women's Newtonianism was 'soft' Newtonianism of the Algarotti kind. They also played an active role in disseminating Newtonianism through translation and exposition. The most famous woman teacher of Newtonianism was Laura Bassi (1711–1788), who lectured on Newtonianism in Bologna from the 1740's to the 1760's.[26] Another Italian, Cristina Roccati, lectured on Newton at the Accademia dei Concordi, Rovigo in 1754.[27] Women also made up the audience of public lectures on science, and there is at least one example of the founding of a scientific society for women, the Natuurkundig Genootshap for Dames, in Middleburg in 1785.[28] Howsoever lowly translation work might appear, we should not underestimate its importance in the communication of ideas and the high level of expertise required. Madame Du Châtelet makes just this point in the Preface to her translation of Mandeville. Here she argues that the work of a translator may be a secondary, even humble, role, but it is nonetheless an important one. Translators are, she says, the merchants of the republic of letters ("negocians de la republique de letters"). And the work of translator "exige une application dont on doit leur savoir d'autant plus degré, qu'ils en attendent mons de gloire." But it is above all, works of reason that are best suited for translation. "De tous les oeuvres ceux de raisonnement me semblent les plus susceptibles d'une bonne traduction."[29] The most celebrated vernacular translation of Newton, was the French translation of Newton's *Principia* by Madame du Châtelet, which appeared posthumously in 1759. The English translation of Algarotti's *Newtonianismo* was the work of a woman, Elizabeth Carter, who published *Sir Isaac Newton's Philosophy explain'd for the use of the Ladies in Six Dialogues on Light and Colours* in 1739. Women also contributed to the diffusion of Newtonianism through pedagogy: Madame Du Châtelet was responsible for producing a manual of physics, her *Institutions de Physique* of 1740, which was explicitly intended to replace Rohault's Cartesian *Traité de Physique* with a Newtonian up-date.[30]

[26] On Bassi, see P. Findlen, "Science as a Career in Enlightenment Italy. The Strategies of Laura Bassi," *Isis*, 84 (1993), pp. 441–69. G. Berti Logan, "The Desire to Contribute: An Eighteenth-Century Italian Woman of Science." *American Historical Review* 99 (1994), pp. 785–812.

[27] Maria Laura Soppelsa and Eva Viani, "Dal Newtonianismo per le dame al Neutonianismo delle dame. Cristina Roccati una *savante* del settecento Veneto," in Pina Tortaro (ed.), *Donne filosofia e cultura nel seicento* (Rome: CNR 1999), pp. 211–40.

[28] One of the first lecturers at this society, which continued in existence until 1887, was Daniel Radermacher, disciple of Voltaire. Du Châtelet was one of the distinguished women cited as an example to members of the society by the male chair, Johann Adriaen van de Perre. I am grateful to Dorothée Sturkenboom for supplying me with this information.

[29] Mandeville, *Fable of the Bees* in Wade, *Studies on Voltaire with Some Unpublished Papers of Madame du Châtelet* (Princeton: Princeton University Press, 1947), p. 135.

[30] First published in 1671. In putting together what is in fact work of synthesis, Du Châtelet may well have been influenced by Samuel Clarke's English version *Rohault's System of Natural Philosophy* (1723),

Du Châtelet also supplied an expository summary of the Newtonian system to accompany her translation of the *Principia*, entitled *Exposition Abregée du système du Monde et explications des Principaux Phénomènes astronomiques tirées des Principes de M. Newton*. If nothing else, this translation of *Principia mathematica* marks out Marquise du Châtelet as an important example of a woman not content to remain on the popular fringes of Newtonianism.

Madame Du Châtelet

Du Châtelet's claim to fame as the most high-powered female Newtonian of the Enlightenment, rests on her posthumously published translation of *Principia mathematica*, and most studies of her Newtonianism focus on that. The very exceptionalness of Du Châtelet among scientifically-minded women of the Enlightenment raises questions about the depth and extension of women's engagement with eighteenth-century science and Newtonianism in particular. However, as the most outspoken female proponent of Newtonianism, she affords us insight into those very questions. In her we have a rare example of the response not just of a female reader of Newton and his followers, but of the target audience of those works specifically directed at women.

Du Châtelet never conformed to the proptotype of the moralistic *femme savante*. On the contrary, she was a high-living and highly-cultured female reader of Newton, described by Voltaire as "une dame qui entend Newton et qui aime les vers et le vin de Champagne."[31] As a result, her reputation has been one of extremes. On the other hand she is celebrated by Voltaire as "Minerve de la France" in his dedication to her of his *Elements de la Philosophie de Newton* where the superlatives of his admiration are undimmed even by Hanna's pedestrian English translation,

> Immortal Emily, vast, pow'rful Mind,
> Pallas of *France*, and Glory of thy Kind,
> Surpassing Age, ev'n in thy Bloom of Youth,
> The Pupil, Friend, of *Newton*, and of Truth.[32]

On the other hand, her philosophical credentials were frequently called in question by male contemporaries who tried to dismiss her as at best "inquiet, curieux et bizarre," or by casting aspersions on her sexual *mores*.[33] Her

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which provides a Newtonian commentary to a Cartesian text. See my "Emilie du Châtelet's *Institutions de physique* as a Document in the History of French Newtonianism" in *Cambridge Studies in the History and Philosophy of Science* (forthcoming.)

[31] Voltaire to Jean François Lerigot de la Faye, *Correspondence*, 5: 285.

[32] Voltaire, *Elements of Sir Isaac Newton's Philosophy* . . . The French original reads "Minerve de France, immortelle Emilie,/Je m'éveille à ta voix, je marche à ta clarté,/ Sur les pas des vertus et de la verité."

[33] In *Radical Enlightenment* (Oxford: Oxford University Press, 2001), p. 86, Jonathan Israel cites Count von Manteuffel's opinion that, "aiant l'esprit vif, inquiet, curieux et bizarre" she used philosophy as a

personal life was certainly nothing if not colourful. Her lovers included, besides Voltaire, Maupertuis, the Duc de Richelieu and the Marquis de Saint Lambert. But a varied love-life hardly justifies the accusation that her intellectual pretensions were a masque for irregular morals, or the kind of twentieth-century interest in Du Châtelet which focuses on her human loves rather than her intellectual passions.[34] And when they have commented on her translation of Newton, modern scholars have often assumed that it should, more properly be credited to her assistant Claude Alexis Clairaut, believing it unlikely that she had any more than a decorative role in the translation of the *Principia*.[35] However, René Taton's work on her correspondence and the manuscript transcription of the translation convincingly argues that she was indeed the translator, and that, although Clairaut did indeed have a role, it was the secondary capacity of checking what she translated. And the more gender-sensitive studies of recent years give full recognition her intellectual achievement.[36]

We are accustomed to regarding Du Châtelet as an exceptionally well-qualified reader of Newton. Yet she apparently had only the basic education appropriate for a lady of her class, before she married and had children. She was proficient in English and Latin, and she learned Italian around the time she met Algarotti.[37] She attributes her more advanced education to chance ("le hasard") which brought her into contact with "gens de lettres" and made her realise that she was indeed a thinking being ("creature pensante").[38] The key man of letters whom she met was Voltaire, who moved in with her at her country estate in Cirey in 1733. The best guide to Du Châtelet's scientific education are her letters. The extant collection covers the period 1733 till her death in 1749. Her comments on French Newtonianism make the letters an important source for the reception of Newtonianism in France. By virtue of the fact that they record the development of her own personal interest in Newtonianism, Du Châtelet's letters for the period document an education in

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fig-leaf of decency, "couvrant l'irregularité de sa conduite par l'affectation de quelque application aux sciences."

[34] E.g., Nancy Mitford, *Voltaire in Love* (London, 1957).

[35] Even such a sympathetic commentator as Ira O. Wade calls her *Institutions de Physique*, "essentially derivative" and claimed she was unlikely to have influenced Voltaire who, she claimed, had "a deeper understanding of Newton." See his *Studies on Voltaire*, p. 221.

[36] René Taton, "Gabrielle le Tonnier de Breteuil, Marquise du Châtelet," *Dictionary of Scientific Biography*, 3:215–7; idem, "Madame du Châtelet, traductrice de Newton," *Archives internationales d'histoire des sciences* 22 (1969), pp. 185–210; Mary Terrall, "Emilie du Châtelet and the Gendering of Science," *History of Science* 33 (1995), pp. 283–310; Judith P. Zissner, "Translating Newton's *Principia*: the Marquise du Châtelet's revision and additions for a French audience," *Notes and Records* 55 (2001), pp. 227–45; eadem, "Emilie du Châtelet: Genius, Gender, and Intellectual Authority," in Hilda L. Smith, ed., *Women Writers and the Early Modern British Political Tradition* (Cambridge: Cambridge University Press, 1998), pp. 168–90. See also Schiebinger (*op cit.*) and Erica Harth, *Cartesian Women. Versions and Subversions of Rational Discourse in the Old Regime* (Ithaca: Cornell University Press, 1992).

[37] Voltaire reports that she learned English in a fortnight. *Correspondence*, 3: 150.

[38] *Fable of the Bees*, in Wade, *Studies on Voltaire*, p. 135.

Newtonianism, and a woman's education at that. At the time of his arrival at Cirey, Voltaire was engaged in writing his *Elémens de la Philosophie de Newton*. It is likely, therefore that her interest in Newton was fired by Voltaire, and not, as is sometimes asserted, by Algarotti, with whom she did not come into contact until 1734, after she met Voltaire. By virtue of her association with Voltaire, and her aristocratic standing, she had the good fortune to meet and be tutored by two of France's ablest mathematicians: Pierre Louis Moreau de Maupertuis (1698–1759), and Claude Alexis Clairaut (1713–1765).[39] Maupertuis, whose *Discours sur la figure des astres* (1734) was the first Newtonian work to be published in France, took up residence at Du Châtelet's house at Cirey in 1737. He certainly assisted her in acquiring the technical expertise the task of translating the *Principia* required, by teaching her algebra and by introducing to her Clairaut, who was later to check her translation of Newton. Whatever the origins of her interest in Newton, Madame Du Châtelet's enthusiasm for his theories is beyond question. She dubbed herself "Emilia Neutoniana" and coined the verb "neutonise" ("moi je newtonise, tant bien que mal") to describe her study of Newton.[40]

While he was writing his *Elements*, Voltaire relied on Madame Du Châtelet to expound and explain Newton's physics. On his own admission, she was "mon guide et mon oracle" in physics and he confessed to Frederick II the indebtedness of the *Elements* to her: "Mme du Châtelet" he told Frederick, "avait sa part à l'ouvrage."[41] This implies that at the time he first moved to Cirey, Du Châtelet had a good grasp of Newtonian science, but her direct knowledge of Newton and Newtonian literature was still limited. In 1738 she claimed to know *Opticks* by heart ("je sais presque par coeur l'optique de M. Newton"),[42] and her writings indicate that she was conversant with sources like Pemberton, Keill, and Du Fay at this early stage. She was, however, diffident about her own expertise in mathematics and geometry. In May 1738 she apologises to Maupertuis that she is not sufficiently versed in algebra to understand fully his *Mémoire sur les figures des corps célestes* (1734) ("je ne sais pas assez d'algèbre pour avoir pu vous suivre partout.")[43] She evidently did not own *Principia mathematica* at this point, but was clearly taking steps to acquire other writings by Newton and on Newtonianism. In a letter to her bookseller, Laurent François Prault, in 1739, she mentions owning Newton's *Opticks* (probably in French translation), Rohault's *System of Natural Philosophy* (with notes by Samuel Clarke), Maupertuis, *De la Figure de la Terre* and

[39] Although she was a lady of fortune, in economic terms, it did not mean having personal disposable wealth: she depended on her husband's permission for all payment. But she could count on support from Voltaire. See Zissner, "Emilie du Châtelet", p. 175.

[40] Emilie Du Châtelet to Algarotti, 25th May 1738, *Lettres*, 1: 229, no. 125.

[41] Wade, *Studies*, p. 114.

[42] Du Châtelet to Maupertuis, 1st December 1738, *Lettres*, 1: 273, no. 152.

[43] Du Châtelet to Maupertuis, *Lettres*, 1: 227, no. 125.

Discours de la Figure des astres, s'Gravensande, *Physicae elementa mathematica*, the Leibniz-Clarke correspondence, Noel Regnault's *Les entretiens phsiques d'Ariste e d'Eudoxe*. She also mentions owning Euclid, Paridies, Malesieux, Guinée, the Marquis de l'Hôpital, Descartes, Whiston, and Musschenbroek.[44] She asks her bookseller, Prault, to obtain for her "les principia mathematica de mr Newton d'une belle édition et de me les fair relier en cuir de roussi dorés sur le tranche, le plustôt que vous pouvez." This list suggests a serious interest in mathematics, and a general interest in Newtonianism. The letter also indicates her impatience to extend her knowledge of Newton by studying *Principia mathematica*. Du Châtelet's eagerness to acquaint herself with Newton's writings extended beyond the scientific works. In 1637 she took steps to obtain a copy of Newton's *Chronology of Ancient Kingdoms Amended*, as well the an abridged French translation by Fréret, *Abregé de la Chronologie de M. le chevalier Isaac Newton, fait par lui meme, et traduit sur le manuscrit Anglois* (Paris, 1725).[45] We do not know if she did obtain a copy of the English original, or what her response to it was. It would also seem that she read Newton's published work on biblical prophecy, *Observations upon the Prophecies of Daniel and St John* (1733), for, in a manuscript treatise entitled "Examen de la Genèse," she delivered herself of the opinion that he had wasted his time trying to find the key to the Apocalypse.[46]

1738

In these early years of her interest in Newton, before she had completed her self-imposed self-education in mathematics and science, her letters show that she was painfully conscious of the limits of her knowledge, especially in understanding Newton's theory of attraction. In 1738, the year in which *Newtonianismo* and *Les Elements* were published, she read Leibniz and the controversy between Newton and Leibniz documented in the Leibniz-Clarke correspondence. Her letters to Maupertuis show her struggle to understand

[44] Du Châtelet to Prault, 16th [February 1739], *Lettres*, 1: 329. She does not give the titles of the books she owned, but we may assume that the Whiston was either *Praelectiones physico-mathematicae* (1710) or its English translation, *Sir Isaac Newton's Mathematical Philosophy more Easily Demonstrated* (1716) and the Muschenbroekwas probably *Essai de Physique* (1737.)

[45] Du Châtelet to Thierot, 16th January 1737, *Lettres*, 1: 165, no. 92, There was also a French summary by François Granet which appeared in 1728.

[46] If this treatise was identified by Ira O. Wade as by her by Du Châtelet. If this attribution is correct, it is the only example, to my knowledge, of a woman Newtonian showing awareness of Newton's theological speculations. However, in Du Châtelet's case, Newton's speculations on biblical prophecy did not find a sympathetic reader, her discipleship of Newton notwithstanding. The examen is actually an examination of the whole bible, including the gospels and apocalypse. Ira Wade observes, the author takes "almost malicious delight in proving that not only the Bible is not divinely inspired, but that the Christian Church is not divinely established." In particular, the book of Revelation is described as fantastical and extravagant. Wade. *Studies on Voltaire*, p. 107.

the concept of *forces vives* and to understand the basis of the Leibniz-Newton clash, without a clear grasp of the mathematics of the laws of motion. She is frank about being out of her depth

> I see (in so as far as I can see) that it is certain that the force or the effect of the force of bodies is the product of the mass by the square of the speed, and that the quantity of the force of a body is the quantity of the movement of the body are two very different things. That being granted by those who oppose *forces vives*, I don't see too well to what they are opposed.[47]

Presenting herself as "un lecteur fort neuf" she asks Maupertuis to be her interpreter, her "maître en Israel" or "St Paul", and asks him to explain why the inverse square law should be preferred to others. Of course, Du Châtelet's "ignorance" was relative. Her sense of the inadequacy of her knowledge of mathematics and science must be measured against the grandeur of her scientific ambitions. This was after all the mentor who had been the "guide" and "oracle" to Voltaire when writing his *Elements*.

The same year, 1738, in which she expressed her reservations about her own expertise in algebra to Maupertuis, was in fact of special significance in Du Châtelet's development as *femme savante*, and *Newtonienne* to boot. That was the year when she came closest to public recognition in France, when her *Dissertation sur la Nature et Propagation du Feu* came close to being awarded the *Prix de l'Académie*.[48] It was also, however, the year in which she gained notoreity, for having dared challenge Dortous de Mairan's *Dissertation sur . . . les forces motrices* (1728) in her *Dissertation*.[49] 1738 is also of particular significance for the impact of the Cirey circle on Newton's European reception. For it was in that year, against a background of enormous hostility from academicians and others in France, that Voltaire's *Elémens de la Philosophie de Newton* and Algarotti's *Newtonianismo per le dame* were published. Madame Du Châtelet contributed to the same Newtonian offensive. Fully persuaded that Newton had rendered Cartesianism obsolete, and recognising the importance of the contribution of French Newtonians, like Maupertuis and Clairaut, in confirming Newton's theories, she actively championed Newton against French opponents of Newtonianism. Angered by anti-Newtonian intrigues at the Académie ("le deparlement contre la philosophie de mr Neuton") she

[47] "Je vois (autant que je peux voir) qu'il est certain que la force ou l'effect de la force des corps est le produit de la mass par le carré de la vitesse, et que la quantité de la force d'un corps, et la quantité du mouvement de ce corps sont deux choses très différentes. Cela étant accordé par ceux que combattent les forces vives, je ne vois trop ce qu'ils combattent . . ." Du Châtelet to Maupertuis, 9th May 1738, *Lettres*, 1: 225, no. 124.

[48] Although this essay did not win the prize, it was nonetheless considered "digne de trouver place dans les recueils de l'Académie," and published in 1739.

[49] Unfortunately, Besterman's editions of both Voltaire's letters and Madame du Châtelet's correspondence omit the text of a letter of July 1738 in which she attempts to win Mairan over to Newton. Voltaire, *Correspondence*, 7: 378.

attributed these to the influence of the Jesuits,[50] and complained to Maupertuis about attacks on French Newtonians, such as he. In her desire to promote Newton in France, she tried to persuade Voltaire to publish his *Elements* in France first and not in the Netherlands.[51] She distributed copies *Les Elémens* in France and, in September, wrote a review of it in the *Journal des Sçavans*.[52] More than that, she herself planned to take part in the publication offensive lead by Voltaire and Algarotti. For she was, at this time was working on her own contribution to popularising Newton's science, her *Institutions de Physique*, publication of which was delayed until1741.[53] From Du Châtelet's comments on Voltaire and Algarotti we can gauge her views on the dissemination of Newtonianism, and, above all, one woman's opinion of Newtonianism for ladies.

Clear indication that Du Châtelet's Newtonianism at this stage was more than anglophilia or a fashionable enthusiasm, is her response to Algarotti's *Newtonianismo* when it finally appeared. Du Châtelet's letters show that she took an eager interest in the genesis of *Newtonianismo per le dame*, after first hearing Algarotti discoursing on the subject matter of the book when he visited Cirey in 1734, and she eagerly awaited its publication. In her letters Du Châtelet is always warm in her expressions of regard for Algarotti as a person, describing him as, "un des hommes que j'ai jamais conus le plus aimable, le plus instruit et le plus doux à vivre."[54] However, while complimenting her "cygne de Padoue" on the elegance of his writing (the "finesse" and "beautés" of his prose), she confided her disappointment with his *Newtonianismo* to other friends. She told Maupertuis, "Il a mis des sublimes discours de M. Newton sur la lumière." But, she complained, "Son livre est frivole. C'est un singe de Fontenelle qui a des graces."[55] The only part of it that was worth anything was the sixth dialogue. The rest was "diffus et vides des choses."[56]

The fictional Italian Marchesa who features in *Newtonianismo per le dame*, and for whose benefit the dialogues are conducted may well have been modeled on the Marquise Du Châtelet (she believed the portrait of the Marchesa

[50] Du Châtelet to Maupertuis, 10th January 1738, *Lettres*, 1: 206–7, nos 113 and 114.

[51] Du Châtelet to Fériol, 22nd and 25th January, 1937, *Lettres*, vol. 1, nos. 93 and 94. She joked that Voltaire's *Elements* provoked outrage in France not because he doubted the truth of religion, but because he doubted the truth of Descartes. Du Châtelet to Algarotti, 2nd February 1738, *Lettres*, 1: 211, no. 117.

[52] "Lettre sur les Elemens de la Philosophie de Newton," *Journal des Scavans*, Sept. 1738, pp. 534–41. She describes this to Maupertuis as "une petite espèce d'extrait des Elémens de Neuton," and explains that in it she flatters Fontenelle in order to enable her to criticise him—"J'y loue un peu de Fontenelle, mais c'est afin d'avoir permission de l blâmer indirectement." Du Châtelet to Maupertuis, 29th September 1738, *Lettres*, 1: 263, no. 146.

[53] See my "Emilie du Châtelet's *Institutions de physique* as a document in the history of French Newtonianism," *Studies in the History and Philosophy of Science* (forthcoming.)

[54] Du Châtelet to the Duc de Richelieu, 17th [August] 1738, *Lettres*, 1: 248, no. 135.

[55] Du Châtelet to the Duc de Richelieu, *Lettres*, 1: 255, no. 139.

[56] Ibid.

was a likeness of herself).[57] However, Algarotti's dedication of the book to Fontenelle indicates that the female interlocutor of his dialogues had a precedent, the naïve fictional Marquise of Fontenelle's *Entretiens sur la Pluralité des mondes*. Algarotti's acknowledgement of Fontenelle was a source of irritation to Madame du Châtelet, who comments on the contradictoriness of dedicating a book on the Newtonian system to the defender of Cartesian vortices who had attacked Newton's theory of attraction.[58] The inappropriateness of the dedication was further underscored when Algarotti's French translator, Du Perron de Castera, added a preface defending Descartes and attacking the Newtonian theory of attraction. The Marchesa of the book, Du Châtelet complains, knows little Italian and less philosophy. She is given jokes, but they are bad ones. She also wrote to Richelieu that while the book was "l'ouvrage d'un homme de beaucoup d'esprit qui est maître de sa matière", nevertheless the style was inappropriate for the topic, "je n'aime pas ce style-là en matière de philosophie, et l'amour d'un amant qui décroit en raison du carré des temps."[59] In May 1738, before ever seeing a copy of either book she told Maupertuis that she had heard that Algarotti's proposed book was to be entitled "Neutonisme à la portée des Dames." Such a title, she observed acidly, made it all the more ridiculous that it was dedicated to Fontenelle, a man who always ridiculed the theory of attraction ("le systeme de l'attractio").[60] Presumably this is why she called Algarotti the "synge de Fontenelle." Her contempt for the minimal level of expertise of its readers that "à la portée des dames" implies is evident in her remark that the book belonged in the "toilettes" and was not for those who know better ("connaissent mieux").[61] Whatever the self-confessed limits of her own knowledge of Newton at this time, Du Châtelet was certainly one of those who "know more", as Voltaire comments to Thierot. Maupertuis, he writes is

> teacher of men, me of children, Algarotti the female sex, but not Madame du Châtelet who knows at least as much as me, and who has corrected many things in my book.[62]

[57] Du Châtelet to Maupertuis, 2nd February 1738, *Lettres*, 1: 213. The portrait appears in the Italian edition published in Naples in 1746, which differs considerably from the first edition on which the French translation is based. It is a more handsome edition, with a clutch of commendatory poems, including one by Lady Mary Wortley Montagu and another by Benjamin Stillingfleet. The text has been substantially rewritten and expanded.

[58] Du Châtelet to Duc de Richelieu, 17th [August] 1738, Du Châtelet to Maupertuis 9th May [1738], and 1st December 1738, *Lettres*, 1: 225 and 258, nos 124 and 152.

[59] Du Châtelet to the Duc de Richelieu, 17th [August] 1738, *Lettres*, 1: 248.

[60] Du Châtelet to Maupertuis, 9th May [1738], *Lettres*, 1: 225, no. 125.

[61] Du Châtelet to Maupertuis, 27th August 1738, *Lettres*, 1: 255.

[62] "[Maupertuis est] le précepteur des hommes, moy des enfans, Algarotti le sexe des dames, mais non pas M^{e} du Chastelet qui en sait au mons autant que luy, et qui a corrigé bien des choses dan son livre." Voltaire to Nicolas Claude Thierot, *Correspondance*, 7: 157–8.

Review of *Les Elements*

Du Châtelet was far more positive about Voltaire's *Elements*, than she was about Algarotti's book. She nonetheless had her reservations. In her review, published in the *Journal des Sçavans*,[63] she welcomes Voltaire's book for making the "glory" of Newton better known in France, a task the more important because of the technical difficulties involved in understanding Newton's original text. These she thinks are such that even an expositor like Pemberton is often as obscure as Newton himself. Resolutely anti-Cartesian, she contrasts the fanciful theories of Descartes, to Newton's "severe truths, founded on mathematical calculations" ("veritez sévéres, fondé sur les calculs mathématiques"). She also makes the point that in making Newton more accessible, Voltaire's *Elements* is not a work of popular science. The title-page claim that it is addressed to "tout le monde" is therefore inappropriate. In view of the level of difficulty involved, it is a book better suited to "le Lecteur raisonnable & attentive." She is in no doubt that a revolution in physics is under way and that the French are contributing to it by confirming Newton's theories. By contrast, Cartesianism is an impediment to scientific advance, like the "remora" which, according to legend, halted sailing ships on their course. Although she expresses doubts about the clarity of Newton's theory of attraction, she singles out for commendation Voltaire's exposition of the laws of gravity.[64] And she hints at the fact that there were omissions in the Dutch edition including the chapter of metaphysics. Nevertheless distances herself from Voltaire, by criticising those who spend time arguing against Descartes, a superfluous exercise, as far as she is concerned. She does not name Voltaire in the review, but she is more explicit in a letter to Maupertuis, where she compares his efforts in refuting Cartesianism to Don Quixote jousting with windmills.[65] Her insistence on the relevance of metaphysics to physics, especially to optics, was to set her at odds with Voltaire.[66]

In respect of expertise on Newton, the Du Châtelet who commented on Algarotti and the *Elements* was not the Du Châtelet who was to translate the *Principia*. Even so, Du Châtelet's comments on *Newtonianismo per les Dame* and *Elémens de la Philosophie de Newton*, are the comments of a relatively well-informed female reader, cognisant of the difficulties involved in reading Newton. She clearly felt that Algarotti's book did not really help its readers understand Newton. And she recognised that Voltaire's book would be over the heads of those who were not "raisonable & attentif". She herself was to

[63] "Lettre sur les Elemens de la Philosophie de Newton," *Journal des Scavans*, Sept. 1738, pp. 534–41.
[64] "Lettre," pp. 534, 535, 538.
[65] Du Châtelet to Maupertuis, 10th February 1738, *Lettres*, 1: 216, no. 120.
[66] "il n'y a aucune partie de la phyique sur laquelle la Métaphysique ait une influence plus marqué que sur l'optique; & ou on est obligé d'avouer que sans son secours on ne peut rendre raison de la façon don't nous appercevons les distances . . .," "Lettre," p. 539.

supply a middle way between these divergent readerships. For her *Institutions de Physique*, composed at this time, was an introduction to contemporary science far more extensive and informative than Algarotti's book, but arguably less demanding than Voltaire's *Elements*. It also supplied what she felt Voltaire lacked: a metaphysics of science. Du Châtelet's disappointment with Algarotti may well have been linked to her own struggle for understanding, which *Newtonianismo per le dame* had failed to assist.[67]

Les Principes

Emilie's translation of Newton was indeed a labour of love—even if progress was disrupted by other *amours*. Completed during the final stages of a difficult pregnancy, Du Châtelet's *Principes* was by any standards a *tour de force*. Much of the controversy about her authorship stems from the fact that she did not live to see it into print, or to defend her title once it was published, for she died of post-puerperal fever in 1749.[68] By contrast with the three works of popularisation emanating from the Cirey circle (*Newtoniansmo*, *Les Elements*, and *Institutions*), Du Châtelet's translation of the *Principia* bespeaks an advanced level of mathematical attainment. At the same time, communicability was evidently a major concern of the translator. The Preface makes the rather bold claim that in the French translation Newton's system is more intelligible than the original Latin or the English translation (i.e. Motte) ("on trouvera souvent Newton plus intelligible dans cette traduction que dans l'original; et même dans la traduction Angloise"). Du Châtelet also supplied a substantial *Abregée du système du monde* to assist her readers in grasping the overall design of the *Principes*.[69] Even this presupposes a reader who is more than merely, "raisonnable & attentif", since it explains the system there described by references to the *Principia* and mathematical demonstration .

The hallmark of Du Châtelet's translation is her rendition in fluent, humanistic prose of Newton's abrupt Latin. This applies just as much to her presentation of the mathematical demonstrations as to the more discursive passages. Communicability does not entail simplification, or vulgarisation. Rather, she affects a simple grandeur of style appropriate to the sublimity of her subject,

[67] Perhaps particularly on the subject of gravitational attraction. At this time she kept pressing Maupertuis for explanations. She did not think that Algarotti's account of it was adequate. Her own doubts about the theory can be detected in her *Institutions de Physiques*. See my "Emilie du Châtelet's *Institutions de physique*."

[68] On the publication history of Du Châtelet's translation, see I. B. Cohen, "The French Translation of Isaac Newton's *Philosophiae Naturalis Principia Mathematica* 1756, 1759," *Archives Internationales d'Histoire des Sciences* 84–5 (1968), pp. 260–90. Taton explains the delay in publishing the first part of Du Châtelet's translation as owing to attempts in the late 1740s to solve problems with Newton's calculations of the lunar apsides with which Clairaut was closely involved. Art.cit. at note 36.

[69] See Zissner, "Translating Newton's *Principia*."

achieved through micro-level terminological choices.[70] There is no space to demonstrate this in detail here. But her adopting a style fitting for the grandeur of her subject may be illustrated from a couple of examples. First, from her translation from the General Scholium to Book III—

> Hic omnia regit non ut anima mundi, sed ut universorum dominus. Et propter doiminium suum, dominus deus παντοκρατωρ dici solet. Nam deus est vox relativa & a servos refertur, & deitas est dominatio dei, non in corpus prprium, uti sentiunt quibus desus et anima mundi, sed in servos.

> Cet être infini gouverne tout, non comme l'ame du monde, mais comme le Seigneur-Dieu s'apelle παντοκρατωρ, c'est à dire le *Seigneur universel*. Car *Dieu* est un mot relatif & qui se rapporte à des serviteurs: & l'on doit entendre par divinitéd la puissance suprême non pas seulement sur les êtres matériels, comme le pensent ceux qui font Dieu uniquement l'ame du monde, mais sur des êtres pensans qui lui sont soumis.[71]

In Du Châtelet's translation of this passage, the impersonal opening pronoun "hic" is rendered as "infinite being." This adds clarity to the subject of the sentence, a move also made by Motte. But, unlike Motte's mere "This Being," Du Châtelet's addition of the adjective "infinite" elevates the subject of the sentence. So too does her choice of the words "empire" and "Seigneur" to render "dominium" and "dominus." This regal divinity, moreover, rules not "servants" ("servos") but "thinking beings" ("êtres pensans"). The connotations of enlightened monarchy that her choice of words implies are reinforced when she renders Newton's definition of God's dominium ("dominatio dei, non in corpus proprium") as "la puissance suprême non pas seulement sur les êtres matériels" (cf. Motte: "Deity is the dominion of God not over his own body"). Du Châtelet's rendition removes the pantheistic connotations of God as *anima mundi*, replacing it with a more mechanistic conception. On another occasion, she sees fit to amend the wording to preserve Newton's dignity, thereby betraying the sensibility of her elevated social class: for example, when, in the second of the *Regulae philosophandi* Newton gives as an example of light, the humble cooking fire, Du Châtelet omits the reference to cooking ("luci signe culinari . . . reflexionis") and renders it as "la reflexion de la lumière sur la terre." Nevertheless, Du Châtelet was not in awe of Newton. She found it endearing that some of his insights came from observing simple things, like soap bubbles:

[70] This is based on the Latin text and not on Motte's English translation. She certainly had access to the 1726 edition lent her by Jean II Bernoulli. It is more than likely that the edition supplied her by Prault in 1739 may have been the first of the three volumes of the Geneva edition by Jacquier and Le Seur.

[71] *Les Principes*, 3: 170.

> Ainsi ces decouvertes si fines qui ne paroissent pas faites pour l'humanité sont nées a ses yeux du sein d'un amusement meprisable, et on peut dire a Mr Newton en cette occasion: *ex iocis infantium et lactantium traxesti veritatem*.[72]

Du Châtelet's translation and the accompanying *Abregée du Système du Monde* did not repeat the success of Algarotti. Their being *by* a woman was not a selling point, notwithstanding the preface, which extolls her as a prodigy among women. The fact that Newton's name does not appear on the title page may be another factor: if so, this only confirms the lack of market value of its being *par une dame* as opposed to *pour les dames*. At all events *Les Principes* was never reprinted in its own day. There is no evidence of its having been widely circulated and I have come across nothing to suggest that it became the standard text for Newton's *Principia* in France, or a primary conduit of Newtonianism in the Francophone world. By contrast, Voltaire's more popular exposition of Newton, his *Eléments*, was widely read both in France and abroad (it was, for example, translated into English by John Hanna in 1738). *Les Principes*, unlike *Les Elémens*, is a specialist work which had little or no vernacular take-up. The specialists, after all, had no need of it, since they were well supplied by the so called "Jesuit" edition of Jacquier and Le Seur which was re-issued twice in the eighteenth century (1760, 1780–85). Other evidence of low demand for translations among specialists is the fact that Du Châtelet's was the only translation of Newton into any language other than Latin or English before the nineteenth century.[73] Even Motte's 1729 English translation was only republished once (1777) before the century was out.

In point of popularity, therefore, Emilie's translation is an exception in the female Newton reception. But that exceptionalism is telling about the level of attainment that was required for science to be accessible to women and to be taken up by them in the eighteenth century. As we have already noted, the *Principia* in any language surpassed the capacities of non-specialists, not least of the scientifically curious women for whom Algarotti composed his *Newtonianismo*. That women did not have the level of mathematical and scientific expertise necessary for tackling the *Principia* is obvious but unremarkable in view of the fact that Newton's mathematics was beyond the reach of most educated men as Mary Wortley Montagu was aware.[74] Even if women were

[72] Wade, *Studies in Voltaire*, p. 191.

[73] The demand for vernacular translations begins in the mid-nineteenth century with a flush of six American editions (1848, 1849, 1850, 1858, 1874, 1885), and a German translation in 1872. A Swedish translation appeared 1927–31, and a Japanese one in 1930. See *The Newton Handbook*, ed. Derek Gjersten (London: Routledge, 1986), pp. 473–82. Although Latin editions continued to be printed into the twentieth century, (1780–1, 1871, 1953, 1965, 1972), the Florian Cajori revision of Motte (latterly revised by I. B. Cohen) has come to supply the demand for editions among specialists in the aftermath of the decline of Latin as the medium of academic discourse.

[74] See note 13 above.

encouraged to take an interest in science, they were, arguably, not expected to have a high level of scientific attainment. This is suggested by the nature and level of those popularising works specifically directed at women, chief among which was Algarotti's *Newtonianismo*. The exceptional nature of Madame du Châtelet's contribution confirms this, as is evident fromVoltaire's preface to the *Principes*, which celebrates her as an exception among her sex. In his Préface, Voltaire, as already noted down plays female capacities in mastering geometry for rhetorical reasons ("C'eût été beaucoup pour une femme du sçavoir la Géométrie ordinaire"), but lauds the female translator as a prodigy equivalent to Newton, despite the fact that her role is that of translator. But what lifts her in status, in Voltaire's encomium, is not so much her genius, as the fact of her being a woman:

> We have seen two prodigies, one, that Newton produced this work, the other that a woman translated and illuminated it.[75]

Such language of compliment must be recognised for what it is, but the irony is that if Algarotti's imagined female reader was indeed typical of female scientific readership at the time, Du Châtelet's achievement was indeed a miracle.

Conclusion

In conclusion, it is probably true to say that for the most part, Newtonianism for ladies was simplified Newtonianism, that had low expectations of its readership. However, this does not mean that women's encounter with Newtonianism was, on balance negative. On the contrary, not only did Newtonianism have to recommend it the fact that it was accessible to a larger-than-specialist audience, but this popular Newtonianism helped create a public for science. Of special importance is the fact that that public included women. And we have the testimony of the women themselves. I have already quoted Mary Wortley Montagu's observation that there are few specialists who can follow Newton's mathematics, but that Newton without numbers is accessible to many. Madame Du Châtelet is a unique example of what a woman could achieve where opportunity was matched by capability—both commodities in short supply in her day. Lady Mary Wortley Montagu's comment finds an echo in a comment by a distinguished woman mathematician of a later generation, Lady Mary Mary Somervile, whose book, *The Connexion of the Physical Sciences* (1834), was designed as a generalist account of contemporary science. In it she notes that only a few specialists, qualified "in the higher branches of mathematical and

[75] "On a vu deux prodigues: l'un, que Newton ait fait cet Ouvrage, l'autre qu'une Dame l'ait traduit & l'air éclaircie," *Principes*, Preface.

mechanical science" can hope to have a "complete acquaintance with physical astronomy." But, she goes on to emphasise that lack such high-level expertise is no excuse refuse the challenge or following their findings—

> it is nevertheless true that sufficient skill in analysis to follow the general outline—to see the mutual dependence of the different parts of the system, and to comprehend by what means some of the most extraordinary conclusions have been arrived at,—is within the reach of many who shrink from the task.[76]

[76] Mary Somervile, *The Connexion of the Physical Sciences* (London, 1834), pp. 4–5.

ESSAY 10

Reflections on Newton's Alchemy in Light of the New Historiography of Alchemy

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The image of Sir Isaac Newton underwent considerable revision during the twentieth century. Notably, the two chief centers for this new "Newtonian Revolution" have been located not primarily in studies of his physics, but rather in studies of his theology and his alchemy. Indeed, these two topics have been something of *causes célèbres* during the past fifty years, and the table of contents for this volume (not to mention the titles and tables of other recent Newton volumes and symposia) clearly bears out the continuing interest in these areas.[1] It would have been difficult to imagine a Newton conference fifty years ago which did not contain a least one paper devoted primarily to his physics. The nascent Newton Papers Project likewise is focused in particular on the theological and alchemical papers which were neglected for so long until twentieth-century scholarship reasserted their importance. Contrary to the fears of those who once thought it judicious to suppress these parts of Newton's activities, Newton's looming stature in the history of science remains undiminished by revelations of his "non-scientific" endeavors. While Newton (like any other early modern figure) can no longer be considered the prototype of the hard-nosed rationalist or positivist scientist succeeding generations wanted him to be, we find ourselves with a Newton undoubtedly even more intriguing than before.

Yet the meaning of Newton's alchemical pursuits and their relationship to the rest of his work remain difficult to pin down. For some, Newton's alchemical studies remain well sequestered from his other activities; for others, they

[1] E.g., James E. Force and Richard H. Popkin, *Newton and Religion: Context, Nature, and Influence* (Dordrecht: Kluwer, 1999.)

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 205–219.
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are central to his wider aims. Most scholars who have devoted themselves to the study of Newtonian alchemy wish to see it as more than a slightly quirky sideshow to Newton's celebrated achievements, but some other Newtonian scholars remain rather skeptical. For example, it remains a matter of controversy whether or not the important concept of "force" emerged from Newton's reading of alchemical authors. It is similarly undecided whether or not Newton's alchemical endeavors were somehow related to his heretical religious beliefs. Thus, whereas much scholarly effort has been expended on Newton's alchemy, and that work has succeeded admirably in revising our portrait of Newton, significant questions remain, and so the task of studying this particularly enigmatic activity of a particularly enigmatic character is far from complete.

Part of the difficulty in pinning down Newton's motives and intent arises from the very nature of his alchemical *Nachlass*. As many authors have pointed out previously, the great majority of Newton's alchemical papers are transcriptions or reading notes of alchemical authorities.[2] Original Newtonian compositions are few and far between, leaving the researcher in a quandary about what Newton's own views and aims really were. Here a contrast with Robert Boyle is instructive. Boyle, a far more loquacious character than Newton (indeed Newton criticized Boyle for being "too open" in this regard, even though Boyle did know how to keep alchemical *arcana* secret), gives us enough information to ascertain the reasons why he pursued traditional alchemy and what his beliefs were. His surviving papers are rich with experimental records, original compositions, correspondence, and so forth. Indeed the promises which alchemy held out for Boyle—clarifications of matter theory, powerful medicines, increased philanthropy, and the suppression of atheism—make so much sense now that we see them (and understand alchemy better) that it seems inconceivable that Boyle would *not* have been deeply involved in its study. Boyle's alchemical quest makes sense. The pieces are there and they fit together in way to satisfy the historian.[3]

To my mind however, the same cannot yet be said of Newton's alchemy. If Newton's taciturnity regarding his own motives and beliefs in regard to alchemical studies is frustrating, his few explicit comments about it are often equally so. A notable example is his off-handed remark to John Locke in 1692 about his disbelief in metallic transmutation. After having rather eagerly connived to get Locke to send him a secret process transcribed out of the notes of the recently-deceased Boyle (Locke was one of his executors), Newton

[2] This was pointed out early on by F. Sherwood Taylor, "An Alchemical Work of Sir Isaac Newton," *Ambix* 5 (1956), pp. 59–84 and reiterated by most subsequent writers on the subject.

[3] For Boyle's alchemy, see Lawrence M. Principe, *The Aspiring Adept: Robert Boyle and His Alchemical Quest*, (Princeton: Princeton University Press, 1998); for a fuller comparison of the Boyle and Newton in this matter, see Principe, "The Alchemies of Robert Boyle and Isaac Newton: Alternate Approaches and Divergent Deployments," pp. 201–20, in Margaret J. Osler, ed., *Rethinking the Scientific Revolution*, (Cambridge: Cambridge University Press, 2000).

treated it dismissively, and claimed to have an unanswerable argument against transmutation (which he did not choose to share).[4] If Newton did not believe in the possibility of transmutation, why was he so eager to have the recipe "for the sake of which Mr. B procured the repeal of the Act of Parliament against Multipliers (i.e., transmuters of metals)"?[5] Why indeed then did he spend so much time reading and interminably transcribing texts whose main goal was metallic transmutation? Why, moreover, did he apparently put Mr. Boyle's recipe and many others to experimental trial? Perhaps Newton was just feigning disbelief in the possibility of chrysopoeia, or perhaps he thought that the real value in proportedly chrysopoetic processes lay elsewhere. In any case, what the "real value" of alchemy was to Newton remains a vexed issue.

Beyond such difficulties which derive directly from Newton, however, there are equally significant complications which have been intruded upon the problem by the larger question of understanding alchemy itself. While our understanding of Newton has undergone massive changes during the past fifty years, our understanding of alchemy has undergone a reworking no less profound. Alchemy is now emerging from the welter of historical and historiographical problems under which it lay smothered for many generations. If the notion of Newton's practice of alchemy no longer provokes the hand-wringing and tooth-gnashing it once did among some historians of the 1950s and 1960s, it is not only because our expectations of a seventeenth-century natural philosopher like Newton have matured, but also because our understanding of alchemy itself has developed and advanced. Nonetheless, incorrect and outdated views about alchemy persist—most assuredly among the educated public, but also among many scholars outside the history of science, and even among some within it. Of course, we cannot understand Newton's alchemy if we do not understand alchemy itself.

Thus it becomes necessary to reexamine Newtonian alchemy in the light of the new historiography of alchemy, because the groundwork (and by consequence much of the subsequent development) for the past half-century of scholarship was set down using conceptions of alchemy which have now been revised. Furthermore, as Newton's alchemical papers become more widely available, it would be helpful to deploy this fundamentally new understanding of alchemy during the further examination of these sources. It is to be hoped that new approaches in the light of new historiography may help resolve some of the puzzling issues which remain regarding Newton's alchemical activities.

There are three interrelated theses from recent studies of alchemy which require our attention: (1) the (non-)demarcation of alchemy from chemistry

[4] Newton to John Locke, 26 January, 16 February, 7 July, 26 July, and 2 August 1692, in *The Correspondence of Isaac Newton*, 7 vols, ed. H. W. Turnbull, J. F. Scott, A. R. Hall, and L. Tilling (Cambridge: Published for the Royal Society at the University Press, 1959–77), 3:193, 195, and 215–19.

[5] *Newton Correspondence*, 3:217.

in the seventeenth century; (2) the recognition of the influence of Victorian occultism and other foreign residues on the historical understanding of alchemy; and (3) the appreciation of the internal diversity of alchemy. This paper will attempt to outline how these theses may conflict with assumptions or conclusions which have been made previously about Newton's alchemy, and to provide some preliminary suggestions regarding how one might proceed in exploring Newton's alchemy further.

Alchemy versus Chemistry

The first thesis from the more recent historiography of alchemy is that *in the seventeenth century "alchemy" and "chemistry" were not regularly distinguished*.[6] Most of the writers in the important textbook tradition of the seventeenth century, for example, explicitly stress the synonymity of the two words. Throughout most of the century the two words are used interchangeably, and in the rare instances where they are not, they are seldom used with their modern meanings. A difference in usage like our own appears only around 1700 (near the time when Newton's own study of alchemy was in decline).[7] By the 1720s, however, the words alchemy and chemistry did refer to different things. The word alchemy was consistently restricted to gold-making activities (chrysopoeia) only in the early eighteenth century at the same time this pursuit was being increasingly labelled as fraud. The reasons for this development are complex, but it was facilitated by a misunderstanding of the Arabic article *al* in *alchemy*, and had the advantage of protecting the development of early modern chemistry as it was being institutionalized from the censures to which chrysopoeia was liable. By creating new and separate referents for the two words, early eighteenth-century writers produced the appearance of a disjunction in the history of chemistry—as if the newly-minted categories of "alchemy" and "chemistry" were only marginally contiguous.

In terms of the study of Newton, the notion that Newton moved gradually from chemistry to alchemy is widespread in the secondary literature. For example, R. S. Westfall illustrated Newton's progression by an inspection of one of his notebooks, Cambridge Add. MS 3975. Westfall observed that reading notes from Robert Boyle give way to notes from *Pyrotechny*

[6] On this issue see William R. Newman and Lawrence M. Principe, "Alchemy vs. Chemistry: The Etymological Origins of a Historiographic Mistake," *Early Science and Medicine* 3 (1998), pp. 32–65; Robert Halleux, *Les textes alchimiques*, (Turnhout: Brepols, 1979), p. 47; and Bernard Joly, "Alchimie et rationalité: la question des critères de démarcation entre chimie et alchimie au XVIIe siècle," *Sciences et Techniques en Perspective* 31 (1995), pp. 93–107.

[7] On Newton's later alchemy, see Karin Figala and Ulrich Petzold, "Alchemy in the Newtonian Circle: Personal Acquaintances and the Problem of the Late Phase of Isaac Newton's Alchemy," pp. 173–92, in J. V. Field and Frank A. J. L. James, eds, *Renaissance and Revolution: Humanists, Scholars, Craftsmen & Natural Philosophers in Early Modern Europe* (Cambridge: Cambridge University Press, 1993).

Asserted by George Starkey and then to the expressly "alchemical" work of the mysterious adept Eirenaeus Philalethes, an author whom Dobbs called the "last great philosophical alchemist."[8] The progression which Westfall believed he saw is, however, predominantly the effect of a questionable classification of the authors mentioned: Boyle as "chemist" and Philalethes as "alchemist."

Now we see that these categorizations are largely illusory. Firstly, the Harvard-educated George Starkey and the wandering Cosmopolite Eirenaeus Philalethes turn out to be the same person.[9] Indeed, a consistent theoretical system in terms of matter theory and methodology undergirds both the works published under Starkey's own name and those he circulated under the name of Philalethes. Secondly, Boyle's own alchemical pursuits have now been clearly documented; he engaged in a long-term quest for the Philosophers' Stone and the alkahest, items of central concern to "both" Philalethes and Starkey, and Boyle's search used methods very similar to theirs. Boyle's obsession for discovering the secret of transmutation was every bit as great as Starkey's.[10] Finally, Starkey has now been revealed as one of the young Boyle's most influential teachers in chymistry;[11] Starkey contributed numerous items both theoretical and practical to Boyle's mature ideas, ranging from avenues to the Stone, to pharmaceutical methods and preparations, to a classification scheme for salts.[12] Thus the presumed move from the "chemical" Boyle, through Starkey, to the "alchemical" Philalethes collapses, and the notion that Newton went from chemistry to alchemy turns out to be problematic and not at all helpful.

Indeed, the notion of treating "Newton's alchemy" as something distinct from "Newton's chemistry," rests upon the drawing of distinctions which are at least highly problematic if not simply anachronistic and arbitrary; we shall see this more fully below. In the future it will, I believe, prove more productive to consider Newton's chymistry (i.e. his "alchemy" and "chemistry") in its entirety, without introducing unnecessary and probably misleading divisions. One goal towards which many Newton scholars are struggling

[8] Richard S. Westfall, "The Role of Alchemy in Newton's Career," pp. 189–232, in M. L. Righini Bonelli and William R. Shea, eds., *Reason, Experiment, and Mysticism in the Scientific Revolution* (London: Science History Publications, 1975), on pp. 191–2; cf. Betty Jo Teeter Dobbs, *The Foundations of Newton's Alchemy, or The Hunting of the Greene Lyon*, (Cambridge: Cambridge University Press, 1975), p. 124, where this notebook "marks the threshold between Newton's straightforward chemistry and his alchemy."

[9] On Starkey-Philalethes, see William R. Newman, *Gehennical Fire: The Lives of George Starkey, an American Alchemist in the Scientific Revolution*, (Cambridge, MA: Harvard University Press, 1994.)

[10] See Principe, *Aspiring Adept*.

[11] On the proposed use of this archaically-spelt word as an inclusive term for alchemy/chemistry during the sixteenth and seventeenth century before the development of the modern split in meaning between the two words, see Newman and Principe, "Etymological Origins," pp. 41–2.

[12] William R. Newman and Lawrence M. Principe, *Alchemy Tried in the Fire: Starkey, Boyle, and the Fate of Helmontian Chymistry* (Chicago: University of Chicago Press, 2002), pp. 207–36 and 273–86.

is the reunion of seemingly disparate parts of Newton's activities; splitting off Newton's "alchemy" from his "chemistry" merely aggravates the situation unnecessarily.

Uncovering the Historical Face of Alchemy

Of course the twentieth-century distinctions between alchemy and chemistry are by no means based merely on a distinction of words. Regardless of the words we use, are there not clear distinctions between what we retrospectively call "alchemy" and "chemistry"? If we consider the pursuits, characteristics, and aims commonly attached to alchemy in much of the secondary literature, these do seem to be quite distinct from those attached to chemistry. But more recent historical work on alchemy shows that many of what are widely-assumed to be distinguishing characteristics of alchemy have, in fact, little to do with the realities of seventeenth-century (or earlier) alchemy. In short, *the conceptions of alchemy most prevalent in the twentieth century were based not on historical insights but rather on ahistorical nineteenth- and early twentieth-century reinterpretations of alchemy*. This is the second major thesis in the new historiography of alchemy.[13]

As noted above, it was only in the early eighteenth century that "alchemy" became synonymous with gold-making at the same time it was repudiated as wholly fraudulent. By the mid-eighteenth century, very few continued to be serious practitioners of alchemy, as Enlightenment writers used metaphors of light and darkness to describe the dawning of chemistry out of the Medieval darkness of alchemy. The secrecy universally connected with earlier alchemical writers, probably coupled with the growing use of alchemical imagery in Germany by Pietists and the Gold- and Rosenkreutz circles, facilitated a juxtaposition of alchemy with other sorts of "secret knowledge", such as magic and divination, which were similarly repudiated by the Enlightenment.[14] By 1800 most references to alchemy grouped it alongside witchcraft, magic, and other practices condemned as "occult." Thus, upon the advent of early nineteenth-century occult revivals, alchemy received new attention not so much for itself,

[13] The material which follows regarding this "second thesis" is summarized from Lawrence M. Principe and William R. Newman, "Some Problems in the Historiography of Alchemy," pp. 385–431, in Anthony Grafton and Newman, eds, *Secrets of Nature: Astrology and Alchemy in Early Modern Europe* (Cambridge, Mass.: MIT Press, 2001); the reader is directed thither for a far more exhaustive treatment than is possible here.

[14] For example, alchemists are condemned alongside magicians and soothsayers in Johann Christoph Adelung, *Geschichte der menschliche Narrheit* (Leipzig, 1785). The metaphor of the light of "new chemistry" dawning out of the obscurity of the old was already being employed by the late seventeenth century; see, for example, the sentiments of that key figure of the French Enlightenment, Bernardle Bouvier de Fontenelle, *Histoire de l'Académie des Sciences* 4 (1702), p. 45, where "les anciens Chimistes" are accused of enshrouding chymistry in "une obscurité affectée," but now modern chemists are dissipating these "tenebres artificielles."

but rather as part of a family of "occult" sciences. Thus alchemy, which before *ca.* 1700 was synonymous with chemistry, and which in the 1720s had been restricted to gold-making and rejected as fraud, had by 1800 become closely associated with magic and the occult.

The linkage of alchemy to occult esoterica continued through the nineteenth century. A key development was Mary Anne Atwood's publication of the *Suggestive Inquiry into the Hermetic Mystery* in 1850. The thesis of this curious volume is that what appear to the untrained reader as laboratory operations in alchemy are actually but "wisdom's envelope, to guard her universal magistery from an incapable and dreaming world," and that "Self-knowledge [is] at the root of all Alchemical tradition."[15] According to Atwood, alchemy is a spiritual practice which operates through Mesmerism, a process known to and hidden by the alchemists. (This thesis is analogous to that of an earlier work written by Atwood's father, probably with Mary Anne's assistance, regarding the allusive revelation of animal magnetism in the Homeric Hymns.)[16] Atwood's treatise touched off a huge resurgence of interest in alchemy, but almost entirely within the context of Victorian occultism. Hundreds of books, including adulterated "translations" of alchemical classics, appeared in the second half of the nineteenth century, all but a very few embracing this new "spiritual interpretation" of alchemy. According to this interpretation, alchemy had little to do with chemistry, and was aimed instead at the internal self-purification, spiritual exaltation and perfection of the would-be adept.

This spiritual interpretation of alchemy led directly into another influential but erroneous view of alchemy, namely the psychological interpretation of Carl Gustav Jung. Immersed in occult esoterica during his youth, by 1913 Jung had embraced a "spiritualist and redemptive interpretation of alchemy."[17] Alchemy was, according to Jung, less concerned with chemical phenomena than with supposed psychic states within the alchemist. Alchemy involved the use of an "active imagination" which led to a hallucinatory state in which the alchemist "projected" the contents of his psyche onto the substances within his vessels. According to Jung, the elaborate imagery and mysterious texts of alchemy describe mental struggles occurring within the alchemist rather than chemical operations. Jung's view, with its emphasis on psychic states and development, shares much with the spiritual interpretation's notion of a spiritual, self-recreating alchemy, and in the final analysis the Jungian view is little more than nineteenth-century occultism translated into "scientific" terminology.

[15] Mary Anne Atwood, *A Suggestive Inquiry into the Hermetic Mystery* (Belfast: William Tait, 1918), pp. 26, 162, and 527–58.

[16] Thuos Magos [i.e. Thomas South and Mary Anne Atwood, neé South], *Early Magnetism, in its Higher Relations to Humanity as Veiled in the Poets and Prophets* (London, 1846).

[17] Richard Noll, *The Aryan Christ* (New York: Random House, 1997), p. 171.

A third interpretation of alchemy devolves from the first two, namely, the notion that alchemy involves a "primitive mentality" inherently different from that of chemistry. The alchemists, this view maintains, envisioned the world in living, organic terms and their apparently material efforts were in fact primarily soteriological. The historian of religion Mircea Eliade propounded these views in the 1930s, most notably in his extremely popular *The Forge and the Crucible*. But a similar view had also been deployed by the historian of chemistry Hélène Metzger in the 1920s. Metzger argued that alchemy was inherently vitalistic whereas chemistry was mechanical, so that the two were not only distinct but mutally exclusive. Nicolas Lemery (1645–1715) was the clean divider for her since he both adopted a mechanistic chemistry and rejected transmutational alchemy in no uncertain terms.[18]

None of these interpretations of alchemy—widespread as they became in the twentieth century—has been able to withstand scholarly historical scrutiny. Yet "alchemy" arrived at the mid-twentieth century so thickly encrusted with such spurious interpretations that its original historical form was all but imperceptible. It was these ahistorical interpretations which were, by and large (with some notable exceptions), associated with alchemy even by historians of science. Small wonder then that the attitudes of many historians of science towards alchemy were so negative. Herbert Butterfield was presumably influenced by one or more of these interpretations of alchemy when he concluded that historians of alchemy wind up being "tinctured with the same kind of lunacy they set out to describe."[19] Similarly, when George Sarton proclaimed in 1950 that all alchemists were "fools or knaves, or more often a combination of both in various proportions," his revulsion for all things alchemical was surely dependent upon the detritus collected around alchemy rather than upon an analysis of original texts.[20] Sarton's classification scheme for *Isis* still groups alchemy under "pseudo-science," alongside "occult" topics it acquired as constant companions only in the eighteenth and nineteenth centuries. Finally, the casual equation in the 1950s and 1960s of alchemy with "mysticism," even to the point of calling alchemy "mystic chemistry"—a conflation which is so odd and so thoroughly annoying to informed modern readers—undoubtedly springs from an acquaintance only

[18] Hélène Metzger, *Les doctrines chimiques en France du début du XVIIe à la fin du XVIIIe siècle* (Paris: Les Presses Universitaires de France, 1923), pp. 99–142; on the influence of Metzger's uncle, the philosopher-anthropologist Lucien Lévy-Bruhl, in introducing the notion of primitive mentalities into Metzger's views on alchemy, see Jan Golinski, "Hélène Metzger and the Interpretation of Seventeenth Century Chemistry," in *History of Science* 25 (1987), pp. 85–97.

[19] Herbert Butterfield, *The Origins of Modern Science, 1300–1800* (New York: Macmillan, 1952), p. 98.

[20] George Sarton, "Boyle and Bayle, the Sceptical Chemist and the Sceptical Historian," *Chymia* 3 (1950), pp. 155–89.

with nineteenth-century occultist constructions rather than with seventeenth-century primary sources.[21]

Specifically in terms of Newton, when historians began to recognize that countless pages of Newton's notes were taken from the likes of Eirenaeus Philalethes and Basilius Valentinus—authors who had been showcased by the developers of the occultist and psychological views of alchemy—they were far more shocked than they needed to be.[22] They, naturally enough, were envisioning Newton in the guise of Mary Anne Atwood's Mesmeric occultist, or in the throes of Jung's "collective unconscious," or reverting to a "primitive mentality." Two centuries of history had succeeded in pulling Newton and alchemy in completely opposite directions: Newton became the Enlightenment's rationalist par excellence, and alchemy an occult pseudo-science.

The impact of these interpretations surfaces frequently in B. J. T. Dobbs' foundational work on Newton's alchemy, courageously begun when there were precious few scholarly studies of alchemy to turn to for guidance. For example, she speaks of Newton's movement from an "exoteric to an esoteric chemistry" using language derived from spiritual interpretations of alchemy and the related division of chemistry from alchemy. A section of *Foundations of Newton's Alchemy* is devoted to the Jungian view, which led her to comment that the allegories and emblems of alchemical works "have nothing to do with chemical realities." Yet many of these allegories and emblems have since been "decoded" into workable laboratory chemistry. Dobbs also built much upon the idea that alchemy was essentially vitalistic and spiritual—a notion more linked to nineteenth- and twentieth-century recastings of alchemy than to early modern alchemy as Newton knew it.[23]

Similarly, Dobbs also wrote repeatedly of the "soteriological function of alchemy," a feature found in various guises in all of the unsatisfactory interpretations of alchemy outlined above. Because of the widespread belief in such a linkage, Dobbs' claim in *Janus Faces of Genius* that Newton's alchemy

[21] See, for example, Marie Boas Hall, "Newton's Voyage on the Strange Seas of Alchemy," pp. 239–46, in Righini, Bonelli, and Shea, eds., *Reason, Experiment, and Mysticism*.

[22] This statement would apply for example, as far back as David Brewster's infamous comments in *Memoirs of the Life, Writing, and Discoveries of Sir Isaac Newton*, 2 vols. (Edinburgh, 1855), e.g., 2:374–5, down to, as one example, Marie Boas [Hall] and Rupert Hall, "Newton's Chemical Experiments," *Archives internationales d'histoire des sciences* 11 (1958), pp. 113–52.

[23] Dobbs, *Foundations*, esp. pp. 26–35, 48, and 191. It must be noted that Dobbs noted the ahistorical nature of Jung's work (*Foundations*, p. 40), but continued to deploy it as a model in several places, e.g. "From the Secrecy of Alchemy to the Openness of Chemistry," in Tore Frängsmyr, ed., *Solomon's House Revisited* (Canton, Mass.: Science History Publications, 1990), pp. 75–94. On the decoding of alchemical imagery, see Lawrence M. Principe, "Apparatus and Reproducibility in Alchemy," in Frederic L. Holmes and Trevor Levere, eds, *Instruments and Experimentalism in the History of Chemistry* (Cambridge, Mass.: M.I.T. Press, 2000), pp. 55–74.

was essentially a religious quest seems a more straightforward conclusion than perhaps it should.[24] Although one can agree with Dobbs' main thesis that Newton's lifework dealt with discovering and demonstrating the activity of God in the world, alchemy is not a necessary feature for this argument. What I mean to say is that seventeenth-century "alchemy" or "chemistry" was not inherently and essentially any more *necessarily* linked to religious interests than other contemporaneous natural philosophical subjects. It is nineteenth- and twentieth-century interpretations of alchemy which stress this linkage as a *distinguishing characteristic* of alchemy. This linkage would not have been considered essential before the middle of the eighteenth-century; indeed, the occult revivals which so transformed perceptions of alchemy were themselves born partly from a reaction against Enlightenment rationalism and secularization. "Alchemy," as a field which "died" before the widespread secularization of the sciences, preserves in its written remains all the marks and expressions of pre-Enlightenment piety, and thus when laid alongside the secularized descendants of early modern physics, astronomy, and other sciences, it naturally appears more closely linked to theological and spiritual preoccupations. But the work of the current generation of historians of science has fully shown that theological considerations were fundamental to *all* branches of early modern natural philosophy. Thus, a comparison between early modern alchemy and other branches of *contemporaneous* natural philosophy (rather than contemporary science) indicates far less distinction on the score of theological preoccupations than previously thought.

Finally, the notion of a "vegetable spirit"—an all-pervasive entity responsible for growth and development in the world—is important to much of *Janus Faces of Genius*. Dobbs was right to note Newton's keen interest in this idea, particularly in the treatise "Of nature's obvious laws & processes in vegetation," and was also right to point out that Newton divided "Nature's actions" into "either vegetable or purely mechanicall."[25] But even though Newton himself explicitly placed "vulgar Chymistry" under the class of the "purely mechanicall," it is not correct uncomplicatedly to equate "vegetable" actions with a vitalistic alchemy distinct from chemistry. Indeed, many "chemists" (e.g. Samuel Cottereau Duclos or Georg Ernst Stahl) espoused the idea of an active spirit in nature, while many "alchemists" held expressly mechanistic views (e.g. Geber or Gaston Duclo). In fact, more recent work has argued that the very divisions of "mechanical" and "vitalistic" are themselves

[24] B. J. T. Dobbs, *The Janus Faces of Genius: The Role of Alchemy in Newton's Thought* (Cambridge: Cambridge University Press, 1991).

[25] Smithsonian Institution Libraries, Dibner Library of the History of Science and Technology, Dibner MSS 1031 B (formerly Burndy MS 16), published in Dobbs, *Janus Faces*, pp. 256–70. See also Dobbs, "Newton's Alchemy and His Theory of Matter," *Isis* 73 (1982), pp. 511–28, esp. pp. 514–18.

problematic, not just the attachment of the former to "chemistry" and the latter to "alchemy."[26]

This point can be illustrated by briefly examining the views the Flemish natural philosopher Joan Baptista Van Helmont. The resemblance of some of Van Helmont's views to those of Newton was mentioned in passing by Dobbs, but his full influence on Newton has not yet been fully explored.[27] Van Helmont recognized two ways in which material changes occur. The first category included most of the methods producible in the laboratory, for example, when liquid quicksilver is dissolved into a transparent fluid, precipitated into a dry red powder, sublimed into white crystals, and so forth. In all these cases, the original quicksilver remains quicksilver, and can always be recovered in its original state by further operations. Even sand, when fused with ashes into glass, can be recovered from glass in its original state. Such operations induce what Van Helmont called *larvae*, or masks; these changes are superficial and straightforward, often involving simple alterations of place within the tiny particles of matter but never involving a true "mutation of essence."[28] The second kind of changes in matter, Van Helmont asserts, occur only when *semina* act upon matter—operating by means of "odors" and "ferments." The *semina* alone produce fundamental "mutations of essence" rather than superficial, "larval" ones. *Semina* are capable, by the power of their "odor" or "ferment," of transforming Van Helmont's basic material substratum—water—into all other substances in the world. In the famous willow tree experiment, the water Van Helmont gave the sapling was changed by the power of *semina* into all the substances in the wood, bark, and leaves.[29]

Newton's two-fold "vegetable" and "mechanical" changes seem very closely akin to Van Helmont's pair. Newton's notions may—although the work to prove this putative linkage remains to be done—be reliant upon Helmontian principles. Now given that Van Helmont posited these two kinds of changes, should one be considered "chemical" and the other "alchemical"? Rather, both sorts of chymical change form for Van Helmont a coherent and comprehensive view of material changes at the microlevel, and neither is complete without the other. Additionally, while the word *semina* bears vitalistic or vegetative connotations, and it is clear from Van Helmont that the *semina* do not operate by a mechanical (contact) means, it nevertheless remains to be demonstrated how

[26] See for example, John Henry, "Occult Qualities and the Experimental Philosophy: Active Principles in Pre-Newtonian Matter Theory," *History of Science* 24 (1986), pp. 335–81.

[27] Dobbs, *Janus Faces*, pp. 49–52.

[28] Joan Baptista Van Helmont, *Ortus medicinae*, (Amsterdam, 1648; reprint ed., Brussels: Culture et Civilisation, 1966), "Gas aquae," p. 75, #10–11. For a summary of Van Helmont's views, see Walter Pagel, *Joan Baptista van Helmont*, (Cambridge: Cambridge University Press, 1982.)

[29] Van Helmont, *Ortus*, "Imago fermenti impraegnat massam semine," pp. 111–17, and "Complexionum atque mistionum elementalium figmentum," pp. 108–9, #30.

truly "vitalistic" they actually are. The emphasis on "vitalism" in Newtonian alchemy, arises, it seems to me, from presuppositions about alchemy imbibed from Metzger and Eliade.[30] In studying Newton's "alchemy" we should avoid the temptation of treating it separately from his "chemistry" as if he moved or evolved from one into the next. Newton has sometimes been portrayed as having both a chemistry and an alchemy alongside it. But like in the case of Van Helmont, we cannot understand Newton's system comprehensively if we dissect it along lines which he himself did not recognize.

Diversity in Alchemy

The third and final thesis from the new historiography is that *alchemy was not monolithic; many competing views and schools of thought coexisted within it, and it could be approached in different ways and deployed for various purposes by various persons*. One of the difficulties in coming to terms with early modern alchemy is its diversity. One can point to "alchemists" interested in a broad array of applications and pursuits—transmutation (chrysopoeia), chemical medicine, chemical pharmacy, the production of salts and other chemical products, and so forth. Some eschewed transmutation in favor of iatrochemistry, some did the opposite, still others were interested in both. The possible theoretical frameworks were even more diverse, even within a single subset of the overarching field of chymistry. Among chrysopoeians alone one can find Scholastics, Neoplatonists, praisers, damners and ignorers of Paracelsus, corpuscularians, vitalists, mechanists, and so on. Practice too was divergent, a chrysopoeian might choose to follow any of the various lines of practice or schools stemming from Geber, Sendivogius, Basil Valentine, "Philalethes," or various other prominent writers. The point is that sufficient internal diversity existed within alchemy that it could be pursued by different people for very different purposes and be approached in many different ways. Recent studies of individual characters underscore the peril of speaking about "alchemy" in broad, essentialist terms.[31]

It is through consideration of this last thesis that we really get to the heart of the matter—what did alchemy, or to speak more accurately, *chymistry* mean for Newton; what did he hope to learn from it? This question has been central to the past half-century of Newtonian studies, and I freely confess that I am

[30] In particular, see B. J. T. Dobbs, *Alchemical Death and Resurrection: The Significance of Alchemy in the Age of Newton* (Washington, DC: Smithsonian Institution Libraries, 1990), which is explicitly based upon notions of vitalism, primitive mentalities, and direct religious functions in alchemy, making the ties to Eliade and Metzger striking.

[31] See, for example, Principe, "The Alchemies of Robert Boyle and Isaac Newton" and "Diversity in Alchemy: The Case of Gaston 'Claveus' DuClo, a Scholastic Mercurialist Chrysopoeian," pp. 181–200, in *Reading the Book of Nature: The Other Side of the Scientific Revolution*, eds, Allen G. Debus and Michael Walton (Kirksville, MO: Sixteenth Century Press, 1998).

unable to answer it comprehensively at this point. Further studies by many individuals on both his papers and his personal contacts are needed, and, as noted above, these will be most fruitful if they are informed by the theses of the new understanding of alchemy presented above. At present, Newton's purposes and aims remain obscure, and I can here give in conclusion only some caveats based upon my current imperfect understanding of early modern chymistry and Newton.

I suggested above that it is unwise to split Newton's "chemistry" from his "alchemy" because that division is based on untenable criteria of demarcation. Now I would suggest that it may be equally unwise to lump together everything which is currently generally classified as Newton's "alchemy," because that category is too easily a "catch-all." For example, among Newton's "alchemical papers" we find many dealing with Philalethes, one of Newton's favorite authors. In the same category of "alchemical papers" we also find many dealing with Hermes Trismegistus.[32] Just because both sets of manuscripts have been lumped together (dismissively) at some time in the past as "alchemical," does it necessarily follow that Newton was looking for the same kind of answers in both? In point of fact the Hermetic texts bear very little resemblance or connection to the Philalethean texts. Indeed, several scholars have assailed the incautious and misleading use of the term "Hermetic" as a synonym for "alchemical"—a usage aggravated by the writings of Frances Yates.[33] One could thus argue plausibly that Newton's reading of Hermes had no meaningful connection at all with his reading of Philalethes.

Newton was clearly interested in matter theory. Among many other documents, his *De natura acidorum*, his famous letter to Boyle of 28 February 1679, and several of the "Queries" in the *Opticks* witness this interest. Part of the interest revealed by these sources involves the forces which hold particles together at the atomic level, and thus is possibly related to the whole concept of Newtonian forces expressed most notably in the case of gravitational attraction. Perhaps Newton hoped that a better understanding of matter theory

[32] On Philalethes, see Keynes MSS 34, 51–54, and 221, and Babson MS 420 among others; see also Dobbs, "Newton's Copy of *Secrets Reveal'd* and the Regimens of the Work," *Ambix* 26 (1979), pp. 145–69. On Hermes, see Keynes MSS 27–29, among others; see also Dobbs, "Newton's Commentary on *The Emerald Tablet* of Hermes Trismegistus: Its Scientific and Theological Significance," pp. 182–191, in Ingrid Merkel and Allen Debus, eds, *Hermeticism and the Renaissance: Intellectual History and the Occult in Early Modern Europe* (Washington, DC: Folger Shakespeare Library, 1988), and also J. E. McGuire, "Neoplatonism and Active Principles: Newton and the *Corpus hermeticum,*" pp. 94–142, in Robert S. Westman and J. E. McGuire, eds, *Hermeticism and the Scientific Revolution*, (Los Angeles: William Andrews Clark Library, 1977.)

[33] Brian P. Copenhaver, "Natural Magic, Hermetism, and Occultism in Early Modern Science," pp. 261–301, in David C. Lindberg and Robert S. Westman, eds., *Reappraisals of the Scientific Revolution* (Cambridge: Cambridge University Press, 1990), esp. pp. 280–90. It must be remarked, of course, that early modern usage routinely extended "Hermetic" to refer to "alchemy" in general, owing to the belief that Hermes was the founder of the science; there seems no reason, however, for moderns to preserve a confusing and ambiguous usage, especially one based on an erroneous belief.

would help him understand that inexplicable property of matter—the fact that it attracts all other matter in proportion to its mass, regardless of the chemical identity of its substance. Now if Newton wanted to inform himself about matter theory, it is only reasonable that he should inquire of those who deal most with matter and its transformations, namely, the chymists. In the seventeenth century, as noted above, the chymists would include not only "chemists" like Boyle, but also "alchemists" like Philalethes. Indeed, it has been effectively argued that Newton's matter theory does in fact bear several important resemblances to that of Philalethes.[34] Here then is one plausible reason for Newton's reading of Philalethes and the many experiments he carried out according to Philalethean processes.

But it is hard to imagine Newton getting any matter theory out of Hermes. On the other hand, we know that Newton was interested in the *prisca sapientia* and in ancient chronology.[35] For these interests, the Hermetic corpus is a logical source. Since Hermes was reputed to be as ancient as Moses, he lived closer to the uncorrupted divine sources of ancient wisdom, and so a pure text of his writings would be desireable in uncovering that ancient wisdom. That same antiquity, if demonstrable, might also help with rectifying the ancient chronologies so necessary for Newton's work with prophecy and eschatology.[36] For such pursuits as these, Philalethes would have been of no value, but Hermes would have been most appropriate.

Thus we have here some plausible explanations of Newton's two specific interests in Hermes and in Philalethes. In the case of latter, the influence of such reading on Newton's natural philosophy has already been demonstrated. Studies analogous to these on *individual manuscript groups* may be the best way to understand "Newton's alchemy." Given the variegated picture of "alchemy" now emerging, this more localized approach seems clearly preferable to trying to pull together and unify the whole range of "alchemical manuscripts" into a common purpose. Indeed, given the theses enunciated above, the question, "What was the meaning and influence of Newton's alchemy?" suddenly appears ill-phrased, because it presumes an essentialist view of alchemy—that alchemy was one uniform thing—and that all the manuscripts perhaps too indiscriminatly labeled as "alchemical" under the influence of an earlier historiography of alchemy were penned by Newton for a single purpose. But if alchemy is heterogeneous, then Newton's purposes in studying it are likely to

[34] Newman, *Gehennical Fire*, pp. 228–39.

[35] The seminal paper in regard to Newton's interest in the *prisca* tradition is J. E. McGuire and P. M. Rattansi, "Newton and the 'Pipes of Pan'," *Notes and Records of the Royal Society* 21 (1966), pp. 108–43. On chronology, see Frank E. Manuel, *Isaac Newton, Historian* (New Haven: Yale University Press, 1963).

[36] Sarah Hutton, "The Seven Trumpets and the Seven Vials: Apocalypticism and Christology in Newton's Theological Writings," pp. 165–78, in Force and Popkin, eds, *Newton and Religion*.

be equally heterogeneous. The question for future scholars should be "Why did Newton read or follow the experiments of *this* author?" After sufficient headway has been made in this fashion, new patterns may well emerge which will prove enlightening to larger questions, and we can begin putting Newton back together in a more satisfying and coherent way.

ESSAY 11

The Trouble with Newton in the Eighteenth Century

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Endgame

Newton has proved to be a man of many faces.[1] Hear the voice of the Barnabite monk Paolo Frisi, mathematician, engineer, and advisor to princes who was not only a Fellow of the Royal Society but also of the Academies of Bologna, Berlin, St. Petersburg and of the Parisian Academie des Sciences. In 1778 in his *Eulogy for Sir Isaac Newton*, written for the Princess Maria Beatrice d'Este, Archduchess of Austria, Frisi described a Newton considerably different from the autocrat and scriptural obsessive who has most recently emerged from the vast archive of his unpublished manuscripts. By the time of the high Enlightenment, Newton's honour had already engendered debate. And even fifty years after his death, Newton's statue was being given a renewed patina. As Frisi described the great philosopher:

> The sweetness of his character, the very grace of his features, the affability with which in ordinary conversation he maintained the same level as others, the modesty with which he avoided any discourse about his own works, the generosity that his employments allowed him to practise, all his virtues had won him the love of all with whom he mixed on familiar terms. His works from the first won him the esteem and respect of everyone else.[2]

[1] Cf., for example, Henry Guerlac, "Where the Statue Stood: Divergent Loyalties to Newton in the Eighteenth Century," in Earl R. Wasserman, ed., *Aspects of the Eighteenth Century* (Baltimore: Johns Hopkins University Press, 1965), pp. 317–34, and B. J. T. Dobbs, *The Janus Faces of Genius. The Role of Alchemy in Newton's Thought* (Cambridge: Cambridge University Press, 1991).

[2] Paolo Frisi, "Eulogy of Sir Isaac Newton," in A. Rupert Hall, *Isaac Newton. Eighteenth-century Perspectives* (Oxford: Oxford University Press, 1999), p. 166.

J. E. Force and S. Hutton (eds), Newton and Newtonianism, 221–238.
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Here we have it then, scientist as saint, reticence as modesty, hyperbole replacing hypotheses, and not for the last time. But Frisi's view was not his alone. It was taken essentially from the earlier *Eloge* by Bernard le Bouvier de Fontenelle who, in turn, had adopted a version taken from Newton's contemporary John Conduitt.[3] The manufacture of Newton's statue immediately following his death in 1727 continued throughout the century. Much was apparently at stake.

It is a remarkable circumstance that Newton's reputation seemed to require refining in a century now generally regarded as dominated by Newton's opus and by those of his apostles. A clue to a lingering unease may have been quietly tendered in 1795–96 when the mathematician and geologist Charles Hutton (1737–1823), in his *Mathematical and Philosophical Dictionary*, puzzled over Newton's less acknowledged passions:

> It is astonishing what care and industry Sir Isaac had employed about the papers relating to Chronology, Church History, &c; as, on examining the papers themselves, which are in the possession of the family of the earl of Portsmouth, it appears that many of them are copies over and over again, often with little or no variation; the whole number being upwards of 4000 sheets in folio . . .[4]

Little did Hutton discern of the extent or the depth of these manuscripts. However, rumours alone had long hinted at a Newton with other things on his mind than the mathematization of gravity and the materiality of light.

And yet, a decade later, in reflections on Newton's early life at Grantham, there was publicly reported the much older and contemporary ruminations of John Conduitt, who had been the great man's immediate successor at the Mint and who had also married Newton's niece, that rather well-connected Whig, Catherine Barton. This early nineteenth-century account, reproducing the views of one closest to the great man, constructed the legend that while at Cambridge Newton had:

> spent the greatest part of his time in his closet and when he was tired with his severer studies of philosophy, his relief and amusement was going to some other study, as history, chronology, divinity, and chemistry, all of which he examined and searched thoroughly, as appears by the many papers he has left on these subjects.[5]

[3] Bernard de Fontenelle, "Eloge de Newton," in *Oeuvres completes*, ed. G-B. Depping (Paris, 1818, repr. Geneve, 1968), t. 1, p. 402. See also, A. Rupert Hall, *Isaac Newton*, p. 73; and John Conduitt, "The Memoir of Newton," King's College MSS, 129.23.

[4] Quoted in Hall, *Isaac Newton*, p. 178.

[5] Edmond Turnor, *Collections for the History of the Town and Soke of Grantham* (London, 1806), p.163, quoted in Hall, *Isaac Newton*, p. 20. This is verbatim from Conduitt's manuscript drafts of Newton's life; see, King's MSS, 129 (3), fol. 3 and 129 (15).

Conduitt's intent had once been clear amid the immediate hurly-burly of Church and Succession politics in the Walpole years. Newton's prestige had then to be shielded from any sense that he wavered from his great philosophical course except perhaps for hints at what amounted to little more than the marginal and speculative diversions of a devout virtuoso.

Set apart from his mathematical philosophy, such sports could thus be quarantined in a Newtonian cabinet of curiosities. This was Newton without the heterodox sting uncovered by more recent biographers. Conduitt's sentiments had thus formed the basis of the famous 'Eloge' by Bernard de Fontenelle in 1727 which was reprinted throughout the century and again in 1818 shortly after Hutton resurrected Conduitt's views. Fontenelle had carefully followed the script he had been provided:

> Quoiqu'il fut attache a l'église Anglicane, il n'eut pas persécuté les non-conformistes pur les y ramener. Il jugeait les hommes par les moeurs, et les vrais non-conformistes étaient pour lui les vicieux et les mechans. Ce n'est pas cependant qu'il s'en tint a la religion naturelle: il était persuadé de la revelation, et parmi les livres de toute éspèce qu'il avait sans cesse entre les mains, celui qu'il lisait le plus assidument etait la bible.[6]

Such a view of Newton then fit nicely into the programme that led to rational dissent in the long English Enlightenment, from Robert Boyle and Newton of course, from Rev. William Derham to the Unitarian Joseph Priestley, as science and faith embraced in mutual attraction.[7]

Newton´s Programme

We now know, of course, that Conduitt's representation was a gracious deceit even while it served to guard Newton's honour. Rumour of heterodoxy had abounded, thus provoking Conduitt's muse—and, interestingly, at the beginning of the next century, notably in a Britain then besieged and soon in a Bourbon monarchy restored, to be judiciously reprinted. Remarkably, what is most striking is that Newton's eminence may not really have needed Conduitt's protection. Newton's theological secret, if then it was a secret at all, was out. Conduitt, and his later nineteenth-century followers, polished the statue for political as well as personal reasons. It was very well known throughout the eighteenth-century that Newton and his disciples dabbled where others would have preferred they had not. Many have written on several of the aspects of this issue elsewhere, particularly in regard to Newton's theological opinions. I will not rehearse those arguments here except to say that, in my view, Newton's

[6] Bernard de Fontenelle, "Eloge de Newton," in *Oeuvres complètes*, t. 1, p. 402.

[7] R. K. Webb, "The emergence of Rational Dissent," in Knud Haakonssen, ed. *Enlightenment and Religion. Rational Dissent in Eighteenth-Century Britain* (Cambridge: Cambridge University Press, 1996), p. 19.

religious sentiments were utterly transparent by the end of the reign of Queen Anne when he published the second edition of his *Principia* and its General Scholium.[8] Nothing could obscure heterodox conclusions, as is evident from many eighteenth-century, High-Church, assaults on his natural philosophy.

Nevertheless, I would like to approach Newton's—and hence Conduitt's—aversion to controversy from another direction. Our current focus on Newton's religious sensibilities, now overwhelmingly clear from his unpublished manuscripts, is in some risk of obscuring the Enlightenment epistemic culture which he and his disciples did so much to create. I would propose here that religious reactions to Newtonian philosophy were explicitly motivated by the powerful convergence of theological and epistemological virtues.[9] While Newton could even be to made appear largely silent on theological matters, the very experimental programme he espoused and which was followed in varying degrees by his acolytes would, nevertheless, push the agenda—*including* its religious consequences—forward.

It is my assertion here that the elaboration of Newton's programme, variously in all of the editions of his *Opticks* and in the General Scholium to the *Principia* in 1713, provided the grounds—at the very least—for the close examination of the more general and disruptive purpose of some of his closest and less reticent disciples. Obviously, the foundation of the Newtonian programme was laid out in Newton's Rules of Reasoning in the magisterial *Principia*, especially in Rule III which established the link between the particular in experiment and the "universal qualities of all bodies whatsoever"; and in Rule IV which looks upon "propositions inferred by general induction from phenomena as accurately or very nearly true . . . " The tie between natural, experimental and moral philosophy was essential to many of Newton's apostles and to their critics. Newton had provided in Query 31 to the *Opticks* particular evidence of his broadest intentions noting, especially, his further hints for experimental research: "And, if natural Philosophy in all its Parts, by pursuing this Method, shall at length be perfected, the Bounds of Moral Philosophy will also be enlarged." This was no mere throw-away; it was his legacy. Conduitt, in his draft manuscripts for a life of Newton, considered him to have "joined morality to Philosophy." Newton especially noted that "no doubt, if the Worship of false Gods had not blinded the Heathen, their moral Philosophy would have gone farther than to the four Cardinal Virtues; and instead of teaching the Transmigration of Souls, and to worship the Sun and

[8] Larry Stewart, "Seeing through the Scholium: Religion and Reading Newton in the Eighteenth Century," *History of Science* 34 (1996), pp. 123–65; and Stephen D. Snobelen, "'God of gods and Lord of lords': The Theology of Isaac Newton's General Scholium to the Principia," in John Hedley Brooke, Margaret J. Osler, and Jitse M. van der Meer, eds, *Science in Theistic Contexts. Cognitive Dimensions*, *Osiris* 16 (2001), pp. 169–208.

[9] Cf. Karin Knorr-Cetina, *Epistemic Cultures: How the Sciences Make Knowledge* (Cambridge, Mass.: Harvard University Press, 1999), pp. 26ff.

Moon, and dead Heroes, they would have taught us to worship our true Author and Benefactor, as their Ancestors did under the Government of Noah and his Sons before they corrupted themselves."[10] Hence, as Conduitt once put it, ". . . what an advantage it is to Christianity in general in this age of infidelity to have a Layman such a Philosopher &c. have spent so much study upon divinity & so publick & strenuous an advocate for it."[11] Thus, as indeed the General Scholium famously asserted in 1713, ancient chronology, scriptural revelation and philosophical method were inextricable.

In this respect, Newton was not unique. One of his earliest disciples, the Rev. William Whiston, who succeeded Newton to the Lucasian professorship at Cambridge—at least until his public expressions of heterodoxy were too much for the university—had taken precisely this approach in his famous *New Theory of the Earth* in 1696. Whiston, who became one of the most controversial theologians of late Stuart and Hanoverian England, had then argued "That 'tis the ignorant and foolish Expositions of Men, not the natural and genuine Sense of the Words themselves, that makes us imagine Scripture, Reason, and the Nature of Things irreconcilable [sic] or contradictory to one another." This Whiston had adopted in part from Galileo with whom he increasingly identified himself as his own prosecution in Convocation gathered momentum. With regard to astronomical systems and scriptural revelation, for example, Whiston stated:

> . . . I am fully persuaded that while the Perfections of God are, as to our assent, deduc'd from their effects, they may in good measure, within certain bounds . . . be judg'd of by what is observable among Men. And as whatsoever is worthy, good, and valuable among our selves, is rightly own'd as a efflux and gift of God; so whatsoever is preposterous, absurd, or disorderly, whatsoever is unworthy, base, or despicable in humane affairs, cannot without great indignity be believed of him; and where we have no other ways of determining, such reasonings ought to be persuasive and decretory.[12]

In the first generation of philosophers who adopted Newton's method, several like Whiston became leading exponents of experimental philosophy to the point of fashioning a very handsome living making explicit what some, Newton included, might have been happier leaving fallow. Public demonstration proved to be problematic.

Newton's immediate apostles included not only the sometime apostate Whiston, but also the metaphysician, Samuel Clarke, and even Clarke's own

[10] Isaac Newton, *Opticks: or, A Treatise of the Reflections, Refractions, Inflections & Colours of Llight*, Based on the 4th ed., London, 1730 (New York: Dover Publications, 1952), pp. 405–6. Query 31.

[11] Conduitt, "Account of Newton's Life and Work at Cambridge," King's MSS, 130 (4). Typescript, pp. 7 and 17.

[12] William Whiston, *A New Theory of the Earth* (London. 1696; repr. New York, 1978), pp. 63, 50. I wish to thank my graduate student, Mr. Jeff Wigglesworth, for bringing this to my attention.

converts such as the Rev. John Jackson. It was Jackson who, in a private letter to Whiston in 1742, laid out how truth was to be quarantined from hypotheses: "I do assure you I am an utter Enemy to all Hypotheses; and never had any [motive?], with any other View but to examine by Evidence, and to assent or dissent according to it: and by examining all the Original Evidence I can come at I find myself oblig'd to differ from all modern, and some ancient, Chronologers likewise."[13] By such means the true ancient theology would be revealed from behind generations of corruptions, the most notable being the Athanasian notion of the Trinity upon which Anglican orthodoxy stood. Here Whiston laid the foundation for Primitive Christianity revived, then with headquarters in Hatton Garden, Whiston's home from which he could hurl invective at the infamous High-Church zealot, his nemesis, Dr. Henry Sacheverell, in the parish pulpit at nearby St. Andrews, Holborn.

`The Business of Experimental Philosophy´

Defaming hypotheses was inherent to the Newtonian moral philosophy. But it was also famously promoted by Whiston, Clarke, and Jackson in their goal of a scripture uncorrupted. This proves critical to an understanding of how Newton came to be viewed as the century wore on. Indeed, the sentiments linking experimental philosophy to a moral imperative would also prove vital to Newton's critics. By the middle of the century, with the end of Whiston's extensive lecturing career and his death in 1752, along with the success of a burgeoning industry in experimental learning and public demonstrations, it might appear that Newton had indeed slain hypotheses, "foolish Expositions," and even scriptural corruption. To believe Conduitt's conceit then, Newton's statue stood well above the fray. Thus, Newton's genius and his reputation were largely unsullied by a pathetic and vulgar curiosity. This was a theme repeated often by Newton's biographers. There was more than an echo of Conduitt in Adam Smith's notion in 1759 that Newton had no public following:

> The great work of Sir Isaac Newton, his *Mathematical Principles of Natural Philosophy*, I have been told, was for several years neglected by the public. The tranquillity of that great man, it is probable, never suffered, upon that account, the interruption of a single quarter of an hour. Natural philosophers, in their independency upon the public opinion, approach nearly to mathematicians, and, in their judgments concerning the merit of their own discoveries and observations, enjoy some degree of the same security and tranquillity.[14]

[13] Leicestershire Record Office, Barker MSS, fol. 138. Jackson to Whiston, November 13, 1742.

[14] Adam Smith, *The Theory of Moral Sentiments*, eds. D. D. Raphael and A. L. Macfie (Oxford: Clarendon Press, 1976), p. 124.

This thoroughly misunderstood the prodigious battle then being contested over the Newtonian epistemology.

Smith could not have paid much attention to the intensity with which Newton's disciples came under attack. If he ever knew of it, he did not appear to comment on the High-Church assault on the Newtonian framework. No sooner was Whiston dead and satirized, than the attack on the experimental programme began in earnest. As Simon Schaffer has shown, John Freke, surgeon at St. Bartholomew's Hospital and Fellow of the Royal Society, in an essay on the causes of electricity in 1752, launched a tirade against purveying experiments to the public—while at the same time admitting that he had not himself conducted any experiments in electricity:

> As to those who get Money by shewing these Experiments, I do not pay so high a Regard to their Performances; because all, who shew any Arts to new Customers, for Profit are bound to try every Means to gain Applause. I would endeavour to ascertain the Laws or Principles by which they are perform'd; which when done, a Thousand Tricks like Legerdemain maybe performed by it, by him whose Time is little worth.[15]

Freke's main target was one of Whiston's late competitors, Benjamin Martin with whom Freke was then engaged in a bitter dispute. Freke, in effect, pulled rank on Martin who, like Whiston, never received the blessing of an F.R.S. In his *Treatise on the Nature and Property of Fire*, Freke attacked the shallow amusements of the experimentalists whose "marvellous Feats, Tricks, and Juglership of the electrical Machines in the Infancy of the Discovery" promoted effects at the expense of causes.[16] Pointing at the prolific Martin, Freke complained there were already far too many books, especially of experiments. And "there are more Answers to Books written to pay a Landlady, or an Ale-house Score, than from any other Cause; especially if their Authors think they answer one whose Character will call it into the World—I know nothing of my Adversary's Finances; but how rich soever he may have made himself by his Show, he seems to have the Blessing of never being liable to the Head-ach from his Thinking too intensely."[17]

[15] John Freke, *A Treatise on the Nature and Property of Fire. In Three Essays. I. Shewing the Cause of Vitality, and Muscular Motion; with many other Phaenomena. II. On Electricity. III. Shewing the Mechanical Cause of Magnetism; and why the Compass varies in the Manner it does* (London, 1752), Appendix, pp. 137–8.

[16] Freke, *A Treatise on the Nature and Property of Fire*, p. iii. On Freke, see Robert E. Schofield, *Mechanism and Materialism. British Natural Philosophy in An Age of Reason* (Princeton: Princeton University Press, 1970), pp. 159–60; and Simon Schaffer, "The Consuming Flame: Electrical Showmen and Tory Mystics in the World of Goods," in John Brewer and Roy Porter, eds., *Consumption and the World of Goods* (London and New York: Routledge, 1993), pp. 490, 495–8, 501–13.

[17] Freke, *A Treatise on the Nature and Property of Fire*, pp.140–1; also J. L. Heilbron, *Electricity in the 17th and 18th Centuries* (Berkeley and Los Angeles: University of California Press, 1979), 294–6.

This personal hostility was further exacerbated by efforts to secure claims to the efficacy of *public* experiments—especially as they were being promoted by Newtonian entrepreneurs like Martin. Ironically in a Newtonian Britain, the non-performist Freke held the very thing Martin sought—the F.R.S., which Martin hoped could one day affirm his experimental, and therefore Newtonian, credentials. His hopes were to be dashed. Martin was denigrated as vulgar and a "Country Show-man." Freke claimed that, by contrast, he thought for himself and "did not let Sir Isaac Newton think for me, after he had been so long dead. I am well satisfy'd," he added, "that had that Great Man been living, and had seen these electrical Experiments, he would not have bow'd very low to this great Philosopher [Martin] for thus supporting his Character. His doing this would be as ridiculous as to see a Pygmy attempt to carry a Giant." So, Freke, managed in one disingenuous breath to disparage the vogue in electrical experimentation, dismiss those who put on public demonstrations, and managed to imply he had nothing against the late great sage. Freke now appears to have come close to one acceptable strategy in the protection of the Newtonian image. Conduitt, in his manuscript account of Newton's character, had asserted that "Sir I. N. did not dwell on what are vulgarly called the sensual parts of learning but true knowledge wch like virtue gives a more solid & lasting satisfaction." But we should therefore recognize that many had doubts about vulgar demonstrations. Indeed, amongst Conduitt's drafts, he cited the philologist André Dacier who had once complained "against those who prostitute the venerable name of Philosopher to persons who pass their life in making experiments upon the pressure of the air or the virtues of the loadstone, or to the Chymist, or to Free thinkers."[18]

There was a constant tension in the Newtonian legacy between philosophical concepts and technical skill. If some concepts like attraction seemed occult, experimental demonstration seemed to pander to vulgar trades. This was one of the on-going difficulties about the appeal of Newton's experimental programme identified by John Conduitt and later by Newton's High-Church critics. As Conduitt put it in his draft comments on Newton's experimental skill:

> I have heard that it is a custom in the Austrian family to teach all the Princes some manual trade, & it is well known the Great Czar from some time in a manner abdicated an Empire to learn Mechanicks, but without discussing wether it be necessary for Kings to have Philosophical hands as well as minds it will be allowed to be a true saying of a late Excellent author (who in more instances than one seemed to prophesy & foretell the productions of Sr. I.N.) that Philosophy would then attain to perfection when either Mechanick labourers should have Philosophical hands or Philosophers have mechanical hands—It

[18] Conduitt, "Newton's Character," King's College, MSS, 130 (7). 2; "Account of Newton's Life at Cambridge," typescript. King's College, MSS, 130 (4). 16.

> was a providential idleness or—it was nothing less than idleness in Sir I.—Happy was it then Sr I. thus exercised at once his body & his mind & his hands as well as his thoughts.[19]

But the problem was a much deeper one. It had much to do with where Newton stood in the epistemic culture of the century which, as in the works of Whiston, Martin, and many others, involved much more than his great, and apparently impenetrable, texts. Successive editions of the *Principia* had done nothing to alleviate those limits. Rather, since Newton's death in 1727, there was increasingly the matter of the interpretations of his followers and their aggressive marketing, daily in the press in many cases, of the efficacy of experiment and demonstration. This trade, however, was an epistemological revolution, a trade in witnessing and replication of natural effects which thereby privileged experimental observation over mathematics as much as over authority and revelation. To critics of such vulgar entertainments, it was thereby relatively easy to raise doubts about Newton's own authority by means of criticizing those of his champions such as Whiston and Samuel Clarke who had made careers of interpreting his principles. In 1768, William Jones of Nayland, defender of the Anglican doctrine of the Trinity, took direct aim at the "great want of perspicuity in Dr. Clarke's way of expressing himself." Here, Jones was attacking not Samuel Clarke's theological views directly but his promotion of the principle of attraction in the famous exchange over occult forces with Leibniz.

Confusion over terms and definitions need not thus be laid precisely at the feet of Newton. Disorder could be directly attributed to his disciples such as "Mr. Cotes, Drs. Clarke, Derham, Keil, Freind, Desaguliers, Mr. Rowning, &c," in respect of "powers, forces, principles, properties . . . ." Certainly, for those who held doubts about the efficacy of experiment, this was a very useful strategy. Newtonian philosophy was thus a snarl of attraction so that ". . . if you do not believe this principle, and make use of it to explain every thing, you are out of the fashion . . . " To those who see Enlightenment Britain as universally Newtonian, the wide-spread doubt is surely a revelation. Jones was then following the opinions of the future High-Church bishop and Hutchinsonian, George Horne, who had expressed many doubts about an experimental epistemology and, by implication, theological opinions which many were certain derived directly from Newton himself. Immediately following Freke's attack on Benjamin Martin, it was Horne in 1753 who had asserted that Newton himself recognized the disastrous influence of his followers, allegedly once complaining "of being killed with the kindness of his friends." There was some truth in this. Newton was not always pleased with 'meer smatterers' in mathematics or those who transformed his principles into amusements for a

[19] Conduitt, "Newton's Manual Dexterity," King's College, MSS, 130 (9).1.

vulgar audience.[20] Thus it was with the very notions of attraction and infinite which led to confusion: "This unhappy misunderstanding of Sir Isaac's terms seems indeed to have been the seed-plot of all our misfortunes," complained Horne.[21]

In some respects, the very success of Newtonianism amongst a public that clamoured for news of experiments proved far more dangerous to orthodoxy than a work like the *Principia* which few might read and fewer understand. In an increasingly popular natural-philosophic culture, therefore, there lay a great threat—a *Principia* demonstrated by experiment was far more subversive than a *Principia* revealed through a prism of proper, orthodox, belief. For a work that was so abstruse and so difficult, Newton's philosophy was made accessible through public lectures and demonstrations by legions of followers. According to Conduitt, for the mathematician John Machin, the rage for demonstrations was problematic:

> Mr. Machin said to Sr I. N. when courses of experiments were first in vogue what a pity it was that when people had a demonstration by Geometry they should trust to their senses wch might be deceived, upon wch Sr Isaac said he first proved his inventions by Geometry & only made use of experiments to make them intelligible & to convince the vulgar.[22]

Especially for many in the High-Church, this practise was an egregious error. By 1753 Horne, like Freke, complained bitterly about the "stupid admiration" of men of genius making experiments that degraded "the philosopher into the mechanic."[23]

By mid-century there were therefore many who had little doubt as to either the foundations of Newton's speculations concerning God or of the widespread consequences of experimental philosophy entertaining the vulgar. In fact, for Horne, Newton's scheme was contradicted not only by Biblical revelation, but by reason, by common sense and even by "Experiments of all sorts." Clearly following Freke's line, Horne stated that:

> . . . I have often thought, (tho' with a less sanction than that of Sir Isaac Newton, *I should not in this age have dared to have said it*,) that the making experiments,

[20] Cf. Larry Stewart, "Philosophers in the Counting-houses: Commerce, Coffee-houses and Experiment in Early Modern London," in Patrick O'Brien, Derek Keene, Marjolein 't Hart, and Herman van der Wee, eds, *Urban Achievement in Early Modern Europe. Golden Ages in Antwerp, Amsterdam and London* (Cambridge: Cambridge University Press, 2001), pp. 326–45, esp. p. 340.

[21] George Horne, M.A. Fellow of Magdalen College in Oxford. *A Fair, Candid, and Impartial State of the Case Between Sir Isaac Newton and Mr. Hutchinson. In Which Is Shewn, How far a system of PHYSICS is capable of MATHEMATICAL DEMONSTRATION; how far Sir Isaac's, as such a system, has that DEMONSTRATION; and consequently, what regard Mr. HUTCHINSON'S claim may deserve to have paid it* (Oxford, Printed at the Theatre for S. Parker, Bookseller: and Sold by R. Baldwyn, in London; and Mess. Merrill, and Matthews, in Cambridge, 1753), pp. 42, 46.

[22] Conduitt, "Newton's Manual Dexterity," King's College, MSS. 130 (9). 3–4.

[23] Horne, *A Fair, Candid, and Impartial State of the Case*, p. 54.

> and calculating proportions, where no further end is proposed by it, and it produces nothing but a stupid admiration, is a very low and servile employment for a man of genius.[24]

And yet, Newton conquered all even to the point of hinting at causes for gravity while, at the same time, repeatedly disavowing any such intention. By mid-century, Horne complained that "the prejudice for Sir Isaac has been so great that it has destroyed the intent of his undertaking, and his books have been made a means of hindring that knowledge they were intended to promote."[25] Having it both ways, all this was confirmation of the conspiracy of the Low-Church, the influence of Clarke, Whiston, and their disciples, and their alliance in what Horne dismissed as "that modern paper building of philosophic infidelity."[26] William Jones concluded in 1768 that "As we cannot believe all these opinions, we are not bound to believe any one of them upon the bare authority of Sir Isaac Newton."[27] By the last third of the century, Newton was under siege. Even Paoli Frisi sought, in his *Elogio* of 1778, to draw attention to the failure of "multiplying experiments than of choosing those that were most precise and decisive."[28]

While High-Church sympathizers were highly suspicious of the rage for experimentalism, the laboratory was not entirely plunged into darkness. Indeed, the increasing fascination with electrical attraction was turned into one route through which to discover the "spark of the Deity." Thus, electrical apparatus seemed to promise to Richard Symes, Rector of St. Werburgh's, in Bristol, the evidence that "what used to be called electrical Matter, is real Fire, and that it exists and is to be found in every Place."[29] He challenged all who doubted:

> You will find too by receiving a smart Shock from a charged Jar, that there are Powers in Nature of which you had not the least Idea. Now if you yourselves with the Help of Proper Instruments can call forth the hidden Fire and perform Wonders with it, who is its Creator, and who now rules and directs it? *You cannot, I think, therefore after such Discoveries as these, treat Christians with*

[24] Ibid., p. 55. My italics.

[25] Ibid., p. 72.

[26] Quoted in Nigel Aston, "Horne and Heterodoxy: The Defence of Anglican Beliefs in the Late Enlightenment," *English Historical Review* 108 (October, 1993), pp. 895–919; esp. pp. 896, 899.

[27] Reverend William Jones, Late of University College in Oxford; and Author of The Catholic Doctrine of the Trinity, *An Essay On the First Principles of Natural Philosophy: Wherein The Use of Natural Means, or Second Causes, in the Oeconomy of the material World, is demonstrated from Reason, Experiments of various Kinds, and the Testimony of Antiquity* (Oxford printed, And Dublin re-printed for William Watson, Bookseller, at the Poets Heads, in Capel-street, 1768), pp. 12, 81.

[28] Quoted in Hall, *Isaac Newton*, p. 128.

[29] Richard Symes, *Fire Analysed; OR, The several Parts of which it is compounded Clearly Demonstrated By Experiments* (Bristol, 1771), p. 18.

> *Contempt for believing, what has been revealed to them in that Book*, which they hold in the highest Esteem, but which you look upon as a Book of Fictions.[30]

Where Symes sought salvation, sufficient to defy the readers of the *Gentleman's Magazine* in 1762 to dispute his laboratory speculations, the public disagreements between Freke and Martin had revealed the deeply held conflicts about the moral effects of experimental philosophy.

By the last decades of the century, therefore, the battle lines had been drawn. There were obviously many, even so, who still asserted the power of Newton's epistemological programme. The mathematician William Emerson, notable for his works on mechanics, saw great value in Newton's slight of "hypotheses, conceits, fictions, conjectures, and romances." By the end of the century, this became the mantra for all of those who wished to be taken seriously for a philosopher and even for an engineer. For some, such distinctions in Newtonian terms and philosophical rules were moral ones deeply linked to the virtues of experimentalism. In 1771, the Glasgow historian and disciple of Adam Smith, John Millar in his *Observations concerning the Distinction of Ranks in Society* asserted that "By real experiments, not by abstracted metaphysical theories, human nature is unfolded; the general laws of our constitution are laid open; and history is rendered subservient to moral philosophy and jurisprudence."[31] This is what Newton had meant in Query 31 to the *Opticks* about finding moral regeneration through experimental philosophy. Thus, in 1771, Symes could also declare that "There can be no Deception in Experiments" and that his own results would not be fairly tested by "any Answerer, unless he contradicts by Experiment, what by Experiment, I think I have clearly demonstrated."[32] By asserting experiment as sovereign method, then, the epistemological legacy of Newton was maintained. Quoting an oration of the Dutch Newtonian and physician, Herman Boerhaave, Symes repeated the basic proposition that all our knowledge of the first principles of things and their qualities "is deriv'd either from such Experiments, as subject them to our Senses or from Consequences by an exact Method of Reasoning deduced from those Experiments." Symes, like many in the last half of the century, was especially intent on the utility of the electrical apparatus and laboratory in a wide range of medical problems. To the great skepticism about electrical effects, Symes responded: "To you, who have no Faith, Conclusions drawn from the silly Conjectures of weak Men, are the Ground and Support of your Unbelief. But will you believe your Senses? Will you not let them determine the Point? Try Experiments!"[33]

[30] Symes, *Fire Analysed*., pp. 45–6. My italics; See Schaffer, "The Consuming Flame: Electrical Showmen and Tory Mystics in the World of Goods," pp. 491, and 507.

[31] Mary Poovey, *A History of the Modern Fact. Problems of Knowledge in the Sciences of Wealth and Society* (Chicago: University of Chicago Press, 1998), pp. 187, and 223.

[32] Richard Symes, *Fire Analysed*, pp. 17–8.

[33] Ibid., pp. 35, and 45.

Beyond the Laboratory

No reading of the epistemic culture of the late eighteenth century can avoid the religious and political implications which Horne and Freke, among many others, believed inherent to the experimental philosophy. The value of experiment–as method–extended beyond the power of discovery. Throughout the length of the eighteenth-century, a great part of Newton's reputation was tied to experiment in large measure precisely because this was the Newton to be encountered in the books and lecture courses of his apostles. And his disciples and detractors alike had raised the stakes. The problem in the age of revolution in the last quarter of the century was that all order seemed to be challenged not merely by numerous mobs but also by those who sought in the laboratory to subvert orthodox belief and authority. Thus, it was Edmund Burke who would reflect on the revolution in France and see in those very upheavals the harvest of "sophisters, economists, and calculators." It was such a view, of course, which would lead Burke to his vitriolic attack on the chemist and Unitarian Joseph Priestley and on James Watt, Jr., both of whom were noted experimentalists in the laboratory as well as in politics. Partly because of Burke, they both personally carried the heavy burden of persecution throughout the period of the French Revolution.[34] The roots of this issue lay, in part, in Newton's reputation throughout the century. We will come back to this point momentarily.

At the beginning of the last quarter of the century, on the verge of the transatlantic revolution that would lead to convulsions in America and in France, it was virtually impossible to avoid the implications of the experimental method. Science would be enlisted by many in the cause of moral regeneration. In his *Experiments and Observations on Different Kinds of Air*, Joseph Priestley suggested that science must necessarily challenge corruption. If, in Newton's view, this was more narrowly conceived as a consequence of the link between scripture and science, the Unitarian Priestley took a broader perspective:

> This rapid progress of knowledge, which like the progress of a wave of the sea . . . extends itself not this way or that way only, but in all directions, will, I doubt not, be the means, under God, of extirpating all errors and prejudice, and of putting an end to all undue and unusurped authority in the business of religion, as well as of science.[35]

Such a messianic vision of the importance of experimental philosophy was no longer simply to be tied to the business of scriptural exegesis. It was to be

[34] Edmund Burke, *Reflections on the Revolution in France*, ed. J. C. D. Clarke (Stanford: Stanford University Press, 2001), p. 238. On Burke see Maurice Crosland, "The Image of Science as a Threat: Burke versus Priestley and the 'Philosophic Revolution'," *British Journal for the History of Science* 20 (July, 1987), pp. 277–307, esp. p. 279.

[35] Quoted in Dan Eshet, "Rereading Priestley: Science at the Intersection of Theology and Politics," *History of Science* 39 (June, 2001), pp. 127–59, esp. p. 139.

the means by which social transformation could become a reality. This, as we know, did Priestley no good in the circles of Anglican and Tory power.

What is equally remarkable about the last quarter of the eighteenth century is the extent to which Newton's doctrine of experimental method nevertheless survived, indeed blossomed in the airs of the early industrial revolution. There are complex reasons for this, of course, not the least being the necessity of numerous trials intended to ensure mechanical projects worked properly. This was the method employed by many of the great engineers such as John Smeaton who made deliberate allowances for the impact of scale in machine models.[36] Nevertheless, during a period of intense competition with the French, the experimental method became increasingly associated with a materialism and taxonomic innovation which challenged accustomed arrangements in the worlds of the naturalist and the chemist. It was not only Burke, therefore, who feared Gallican influence. Many British industrialists were especially suspicious of French motives, given the long history of industrial espionage and of the recruiting of skilled workmen in which the Ancien Regime connived.[37] It was in these circumstances in the 1780s that James Watt, who was among other things an extremely accomplished and learned chemical experimentalist, reflected that the best way to keep industrial secrets British would be "hints of the frog & snail diet, not the least powerful; nothing will make an englishman amends for the want of beef & pudding [especially if...] being obliged to drink sour wine instead of honest ale."[38] Watt shared a hostility which many openly expressed. The skills of mechanics and the plans of industrialists could not avoid being tested amidst the cauldron of social transformation and international rivalry that marked the early industrial revolution.

More than one might normally have expected, Continental, especially French, experimentalism to have been regarded as yet another novelty in the long train which came as a consequence of atheism and materialism. The French, apparently, had seen the materialist programme through to its inevitable end. Burke thus reflected views on the effect of experimental philosophy which were ardently voiced by the Reverends William Jones and George Horne. Here was one legacy of Newton and the propagation of his method in England as on the Continent. Just as had been the case in the age of Newton, Burke declared in 1795 that the experimental philosophy "is like that of the principle of evil himself: incorporeal, pure, unmixed, dephlegmated,

[36] Larry Stewart, "A Meaning for Machines: Modernity, Utility, and the Eighteenth-Century British Public," *Journal of Modern History* 70 (June, 1998), pp. 259–96, esp. pp. 275–6.

[37] Cf. John Harris, *Industrial Espionage and Technology Transfer. Britain and France in the Eighteenth Century* (Aldershot, Hants: Ashgate, 1998), and Liliane Hilaire-Perez, *L'invention technique au siécle des lumiéres* (Paris: Albin Michel, 2000.)

[38] Birmingham Central Library (hereafter BCL), James Watt Papers, 6/36/37. James Watt to Josiah Wedgwood, January 28, 1784.

defecated, evil."[39] This was not the view of Burke alone of course. In the same year, in reaction to the French Terror, George Horne concluded that the growth of atheism promised by a materialist view of nature "hath now actually come to pass."[40] The lesson of France was not to be ignored. During the French Revolution, when Horne was finally elevated to the Bench as Bishop of Norwich, these warnings reached receptive ears. Haunted by fears of blasphemy and unbelief, there was a sense of an establishment under siege. This meant more demands for a sound theology safe from the insidious influence of those who demanded revisions in belief and who undermined the pillars upon which rested the entire British social order.[41] There were dangers, said Horne, in a philosophy which had "threatened to banish all religion out of the world."[42]

But, William Jones proposed, there was a solution—it involved dismissing the authority adhering to the Newtonian philosophy:

> *Sir I. Newton and Dr. Clarke had formed a design, by introducing certain speculations founded on their new mode of philosophizing, to undermine and overthrow the theology of the Scripture*, and to bring in the Heathen Jupiter or Stoical *anima mundi* into the place of the true God whom we Christians believe and worship. This will seem less extravagant, when it is considered Mr. Boyle had also expressed his suspicions, many years before, that Heathenism was about to rise again out of some speculations, and reputedly grand discoveries, in Natural Philosophy. Yet I am not willing to believe, that the eminent persons above mentioned had actually formed such a design. What advantage unbelievers have, since their time, taken of their speculations in divinity and philosophy, and of the high repute which has attended them, and of the exclusive honours given to mathematical learning and mathematical reasoning, is another question; and it calls for a serious examination at this time, when *the moral world is in great disorder*, from causes not well understood.[43]

The invocation of Robert Boyle tied Horne and Jones to older concerns that would link the equally uncertain worlds of the Restoration and the Regency. By the end of the eighteenth century, it was no longer merely a question of Clarke, or Whiston and even Newton, but more immediately "of the *mode of philosophizing*" which had seduced so many. It is, perhaps, ironic that in the aftermath of the French Terror that Newton's High-Church critics were far

[39] Burke, *Letter to Noble Lord*, quoted in Crosland, "The Image of Science as a Threat," p. 295, n. 127.

[40] William Jones, M. A., F. R. S., *Memoirs of the Life, Studies, and Writings of the Right Reverend George Horne, D. D. Late Bishop of Norwich* (London, 1795), pp. 31–2 & n.

[41] C. B. Wilde, "Hutchinsonianism, Natural Philosophy and Religious Controversy in Eighteenth Century Britain," *History of Science* 18 (March, 1980), pp. 1–24, esp. p. 11; and John Gascoigne, *Cambridge in the Age of the Enlightenment* (Cambridge: Cambridge University Press, 1989), p. 268.

[42] Jones, *Memoirs of the Life, Studies, and Writings of the Right Reverend George Horne*, p. 32; quoted in Gascoigne, *Cambridge in the Age of Enlightenment*, p. 262.

[43] Jones, *Memoirs of the Life, Studies, and Writings of the Right Reverend George Horne*, pp. 36–7. My italics.

more willing to accept the link between theology and experimental philosophy than were his supporters. It is arresting that the debate over method was so heavily laden by expressions so political. This is a matter which, in my view, must force us to further scrutinize the legacy of Newton and to explore where the statue then stood in an age of Revolution. At the very time that Burke and Jones raged against the heat of laboratory experiments, then seen of course as the legacy of materialism and atheism, James Watt was in correspondence with the royal physician James Lind about these very matters. Lind, who was well acquainted with experimental chemistry, reported on a conversation he recently had with the Swiss chemist Jean-André de Luc:

> He [de Luc] is much pleased to be informed by you of your having made the different Airs without either Water or Acids, He being no friend to Theories, either Philosophical or Political that are founded on falsehood; and are propagated by force and such he thinks French Chemistry and Politics to be, Indeed there seems to have been such a wonderful coincidence in sentiments of some of the modern Chemists in this country that I have declined to take part in the Pneumatical practice of Medicine from a detestation of having any connexion with such a set of miscreants.[44]

Conclusion

Just as Burke and Jones had revealed, the language of experiment had once again become the rhetoric of politics. Newton had known that there was a moral consequence to experimental philosophy and it emerged most obviously in times where there was much at stake in the political world. Witness, for example, the hope of the radical, democratic, physician Thomas Beddoes for courses in chemistry in Bristol. Echoing a proposition of Priestley from a generation earlier on the challenge to corruption, Beddoes wrote to James Watt that:

> The people here attend to chemistry with interest. I am glad of this, not merely in acct. of its direct utility—but I think that the effect of a number of people receiving agreeable ideas together may be to soften animosity & that there will be thus a chance of preventing some acts of barbarity in the times that I fear are coming.[45]

In Beddoes' view, just as Newton had once suggested, there could be a moral regeneration linked to the exploitation of experimental philosophy. Care, however, was demanded in vulgar demonstration. It was left to James Watt—engineer and experimentalist—to provide the most ringing endorsement of

[44] BCL, JWP 4/65/21. James Lind to Watt, February 20, 1795.
[45] BCL, JWP, W/9/7. Thomas Beddoes to Watt, 21 April (?).

the Newtonian programme. This was a private communication to a Manchester physician concerned with the new pneumatic chemistry in which Watt's work is little known and still unappreciated. Watt wrote:

> Knowing the insufficience of theory & the incompetence of the human mind to embrace every circumstance of a Complicated subject of any kind, I am a great friend to experiment. Even in the simple science of mechanicks, I cannot trust to theory, much less in the obscure paths of Physiology; let us therefore try our theories by experiment, when one thing does not do, let us try another, until we come to the most apposite.[46]

There could have been no better summation of the Newtonian experimental programme. There were no hypotheses here it seemed.

Among the industrialists and chemists at the end of the eighteenth century, in an age laden with political consequence quite as much as was Newton's own, his method of philosophizing had found its most compelling influence. To have read back into the eighteenth century, therefore, a natural language of science and politics, wherein Newton's *Principia* set the standard, later to be followed by Adam Smith's rational management of the economy and the provocatively modern discourse of power and representation suggested by Midland's entrepreneurs, seemed to fling out of doors metaphysical entities in exchange for experimental ingenuity and the material plurality of the taxonomist's delight.

But was it so? Is it not the case that the pre-Banksian Royal Society seemed utterly puerile in its transactions, philosophical or otherwise? The last half of the century was, it appears, a contest over Newton's standard—a struggle fought not within the bounds of such an institution as the Royal Society but a contest where natural and experimental philosophy could not entirely escape from the persistence of theological and religious baggage despite the effort. The *odium theologicum* of the doctrinal divisions of Newton's own lifetime were not to be easily disguised even in the promotion of experiment. It can be no wonder, then, that in 1806, when the Napoleonic threat loomed large, Conduitt's gracious image of a Newton who sought relief in chemistry and chronology, would be resurrected to quarantine a serious, and British, philosophical method from unsavoury or heretical consequence.

[46] BCL, JWP, 4/65/19. James Watt to Thomas Percival, November 24, 1794.

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